1/385
12
PW(10)
4 Mating Gate Code Structure
PW Limits
7A
7B
6A
6B
3
2
8
5
1

FIG 1A

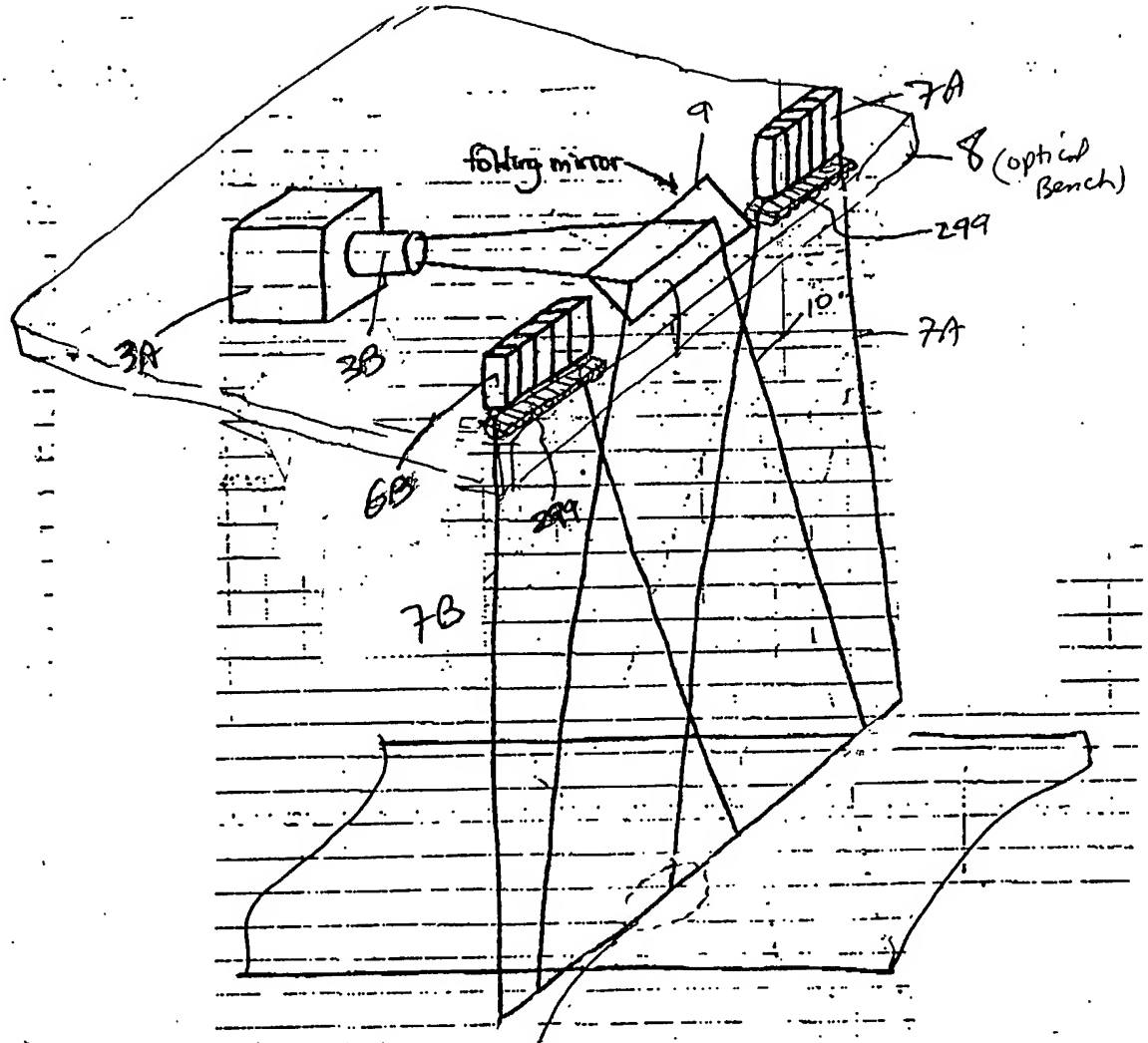


FIG. 1B1

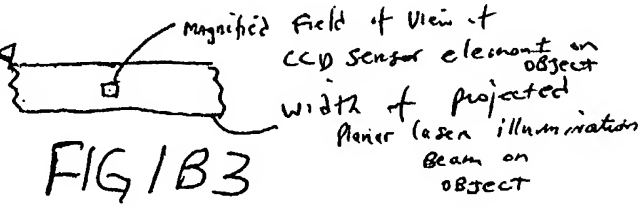


FIG 1B3

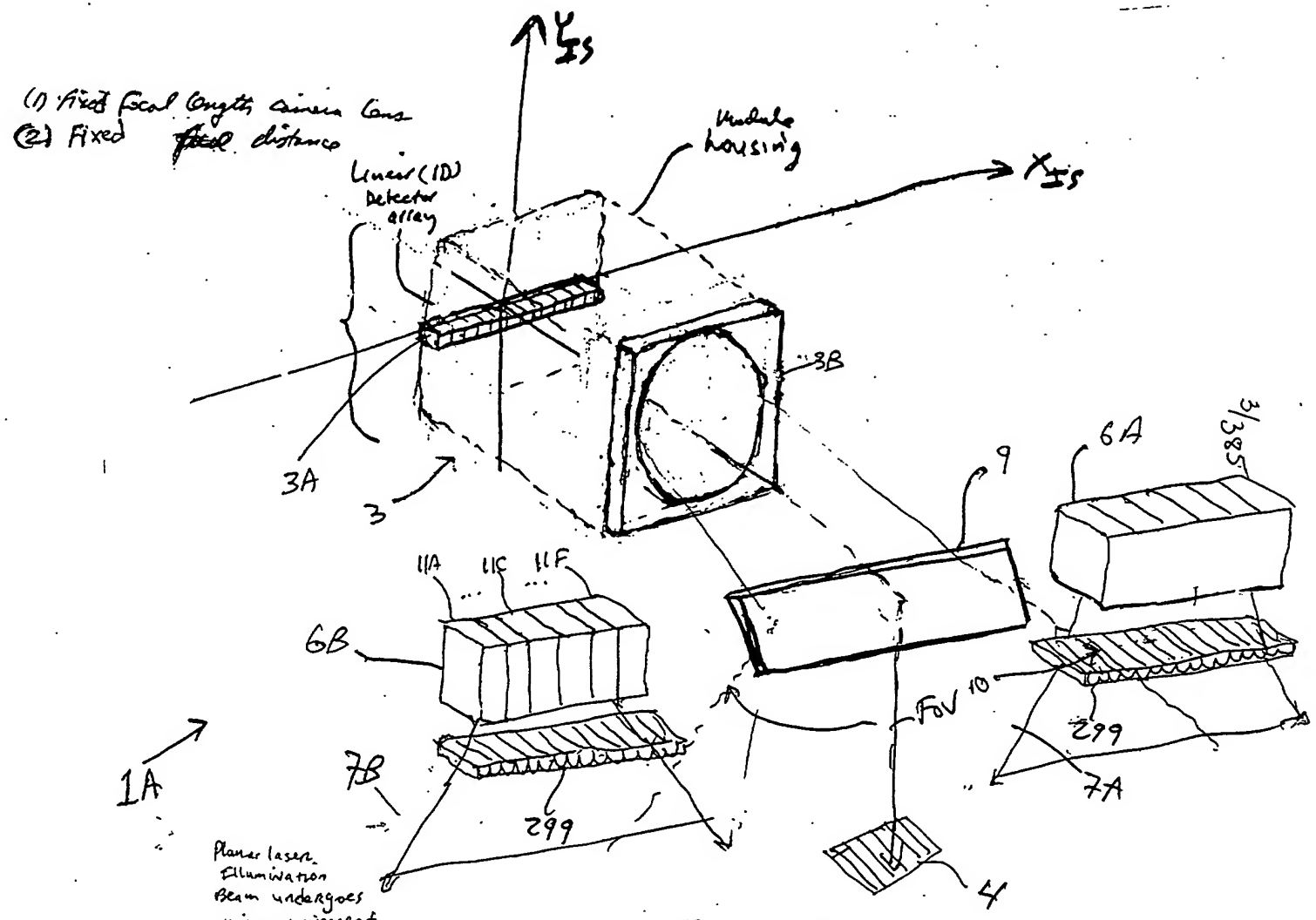

(1) Fixed focal length camera lens
(2) Fixed focal distance
Linear (1D) detector array
Module housing
Y_{FS}
X_{FS}
3B
3A
3
9
6A
3/385
11A
11C
11F
6B
FoV
10
299
7A
7B
299
1A
Planar laser illumination beam undergoes micro-movement
4

FIG. 1B2

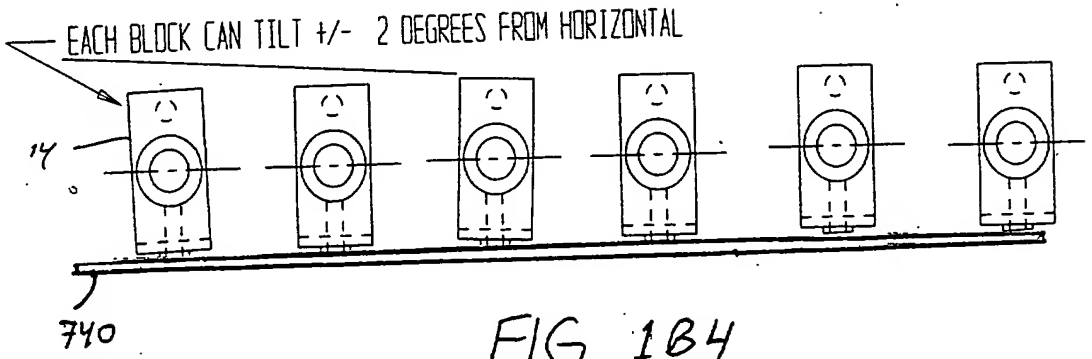


FIG. 1B4

VLD BLOCK CAN PITCH FOWARD FOR ALIGNMENT WITH OTHER VLD BEAMS

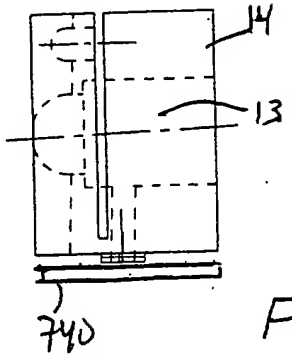


FIG. 1B5

2003-02-27 09:44:52 0000384

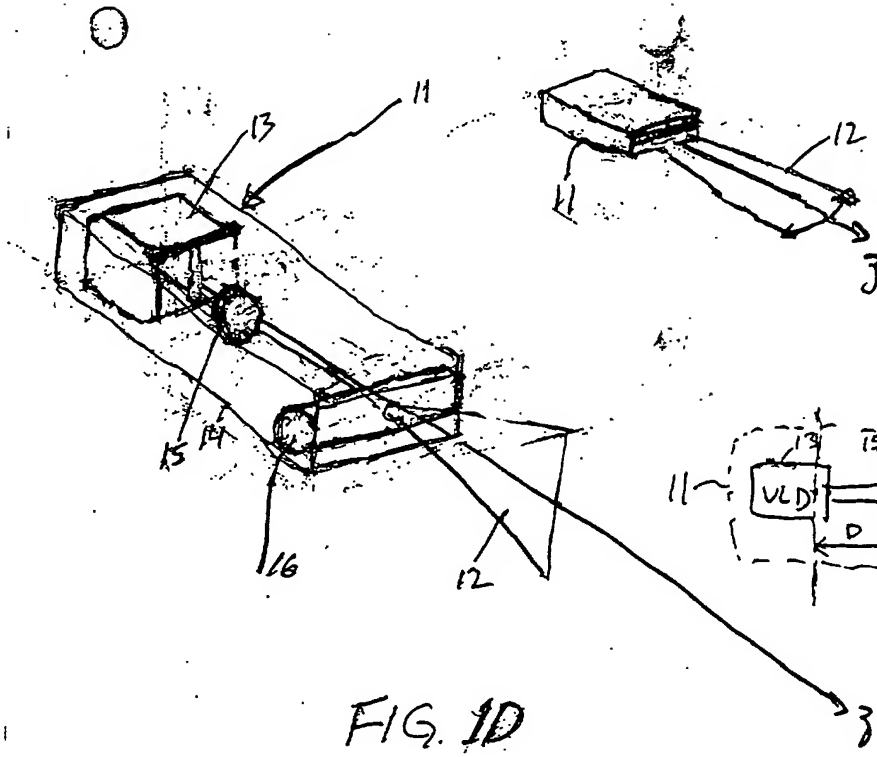


FIG. 1D

FIG. 1C

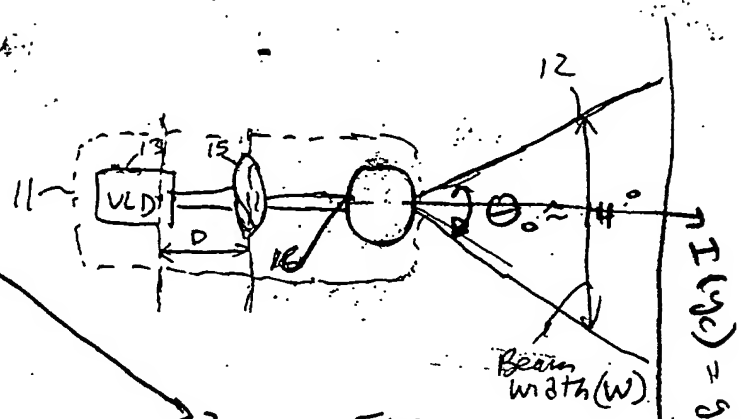


FIG. 1E1

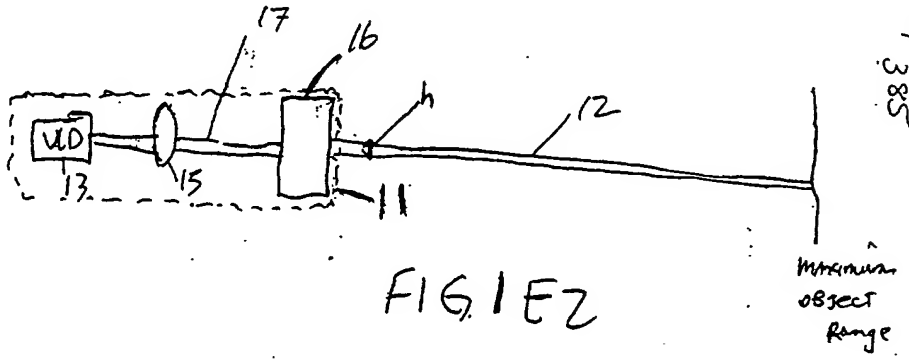
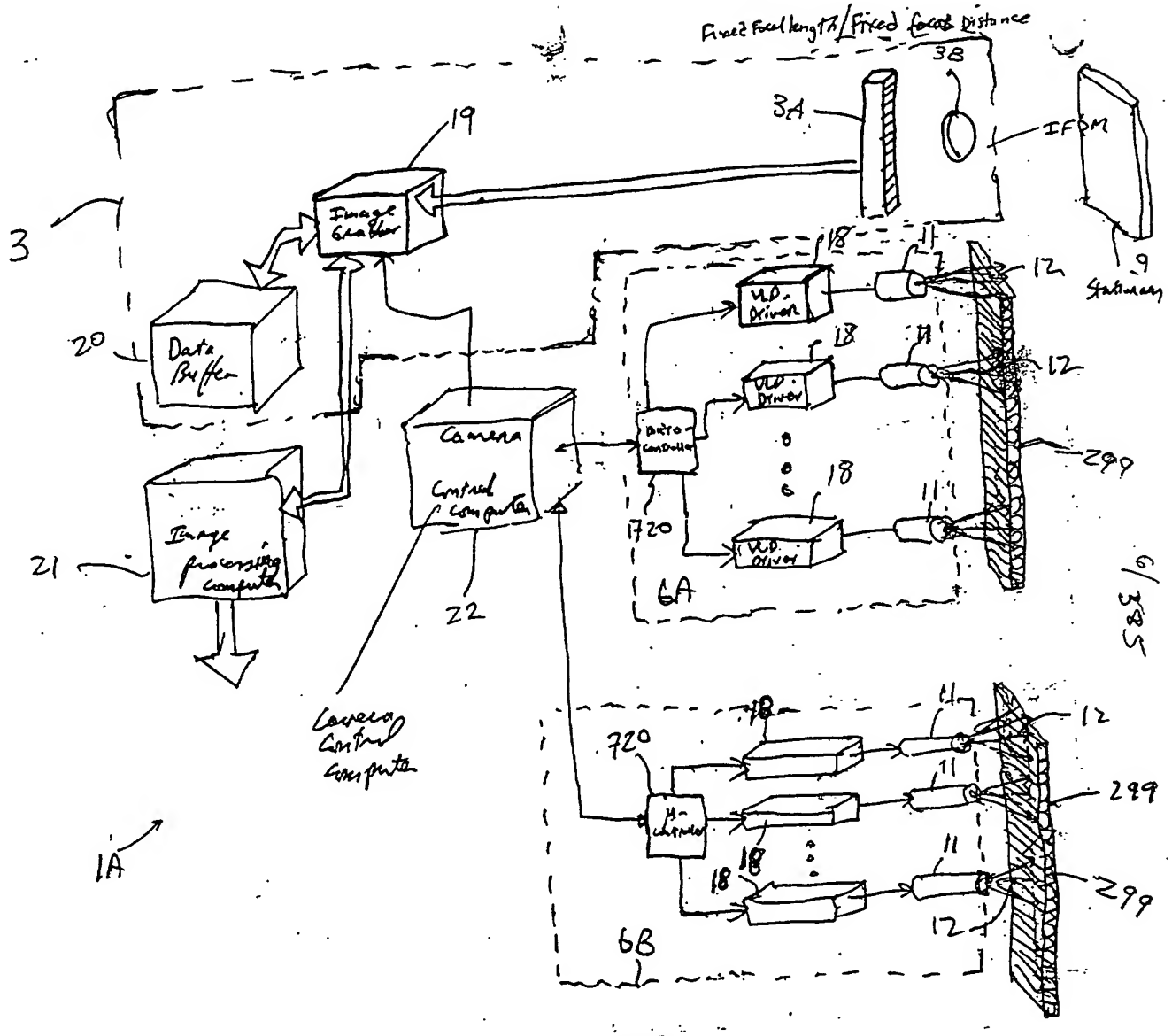


FIG. 1E2

EXHIBIT 1002 - 02/27/2004 - 385


Fixed Focal length/Fixed focal distance
3B
3A
IFOM
19
Image Grabber
3
18
11
12
9
Stationary
20
Data Buffer
VLD driver
18
11
12
Camera
Control computer
Data controller
299
18
720
11
21
Image processing computer
22
6A
6/385
Camera Control computer
18
11
12
720
299
1A
18
18
11
299
12
6B
FIG. 1F

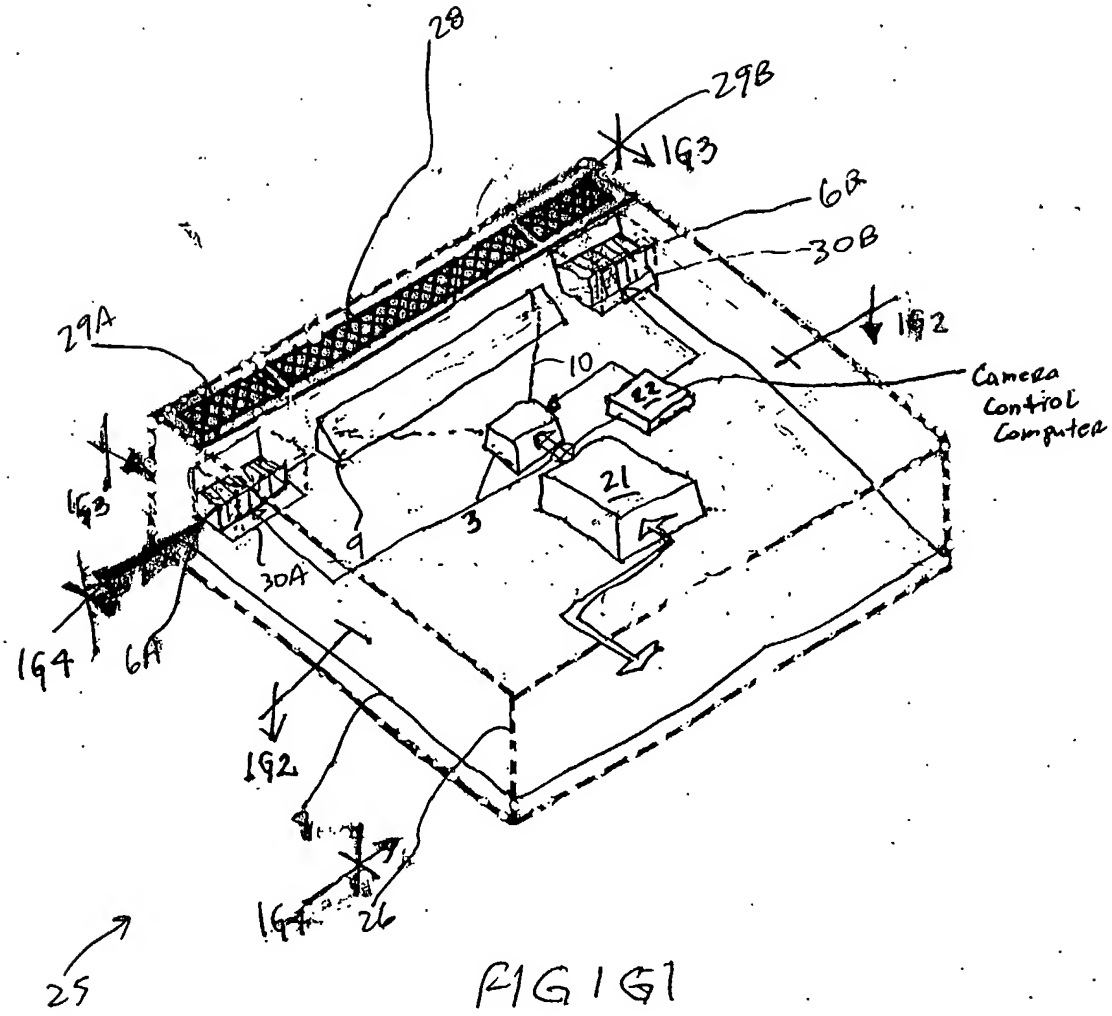

28
29B
IG3
6B
30B
IG2
29A
10
22
Camera
Control
Computer
IG3
21
3
9
30A
IG4
6A
IG2
IG4
26
25

FIG 1G1

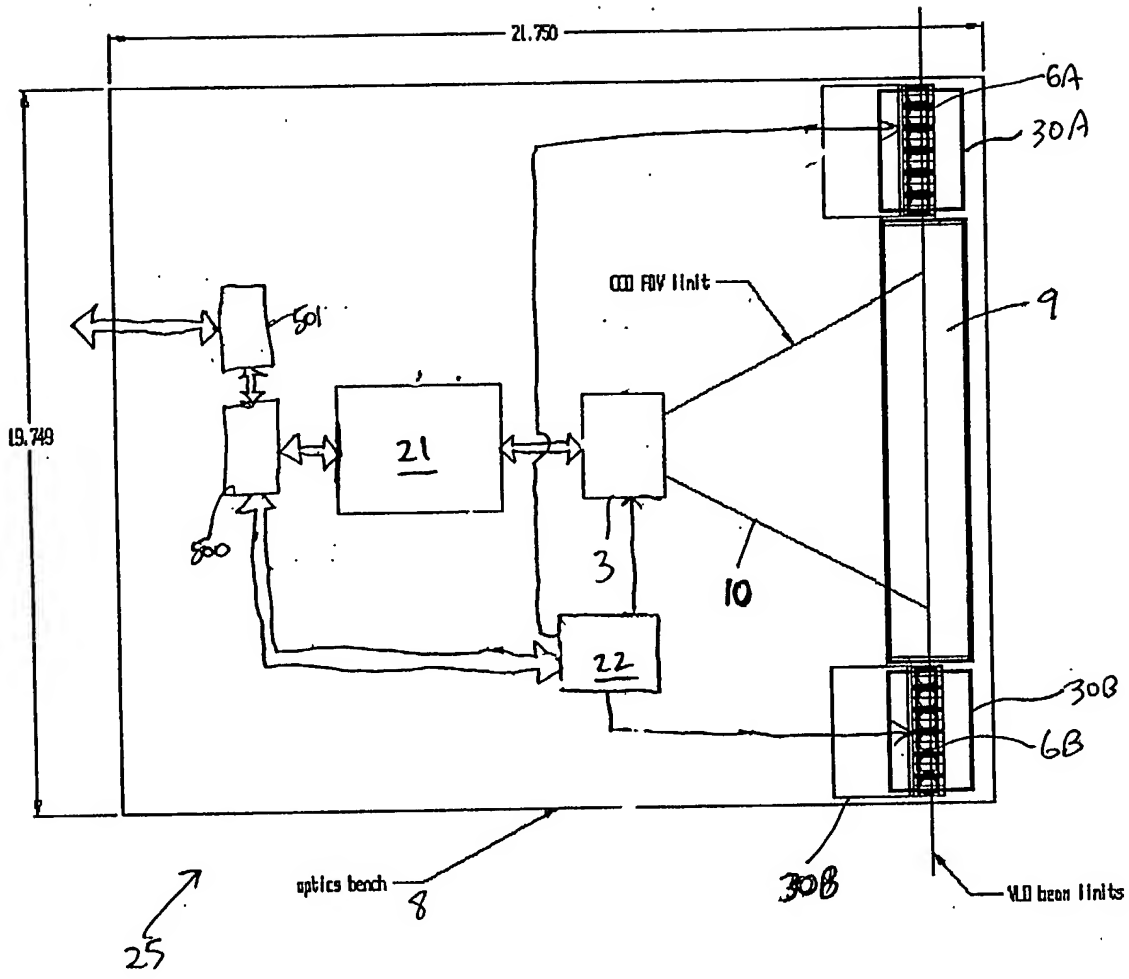

21.750
19.749
6A
30A
CCD FOV limit
9
501
21
500
3
10
22
30B
6B
optics bench
8
25
30B
VLD beam limits

FIG. 1G2

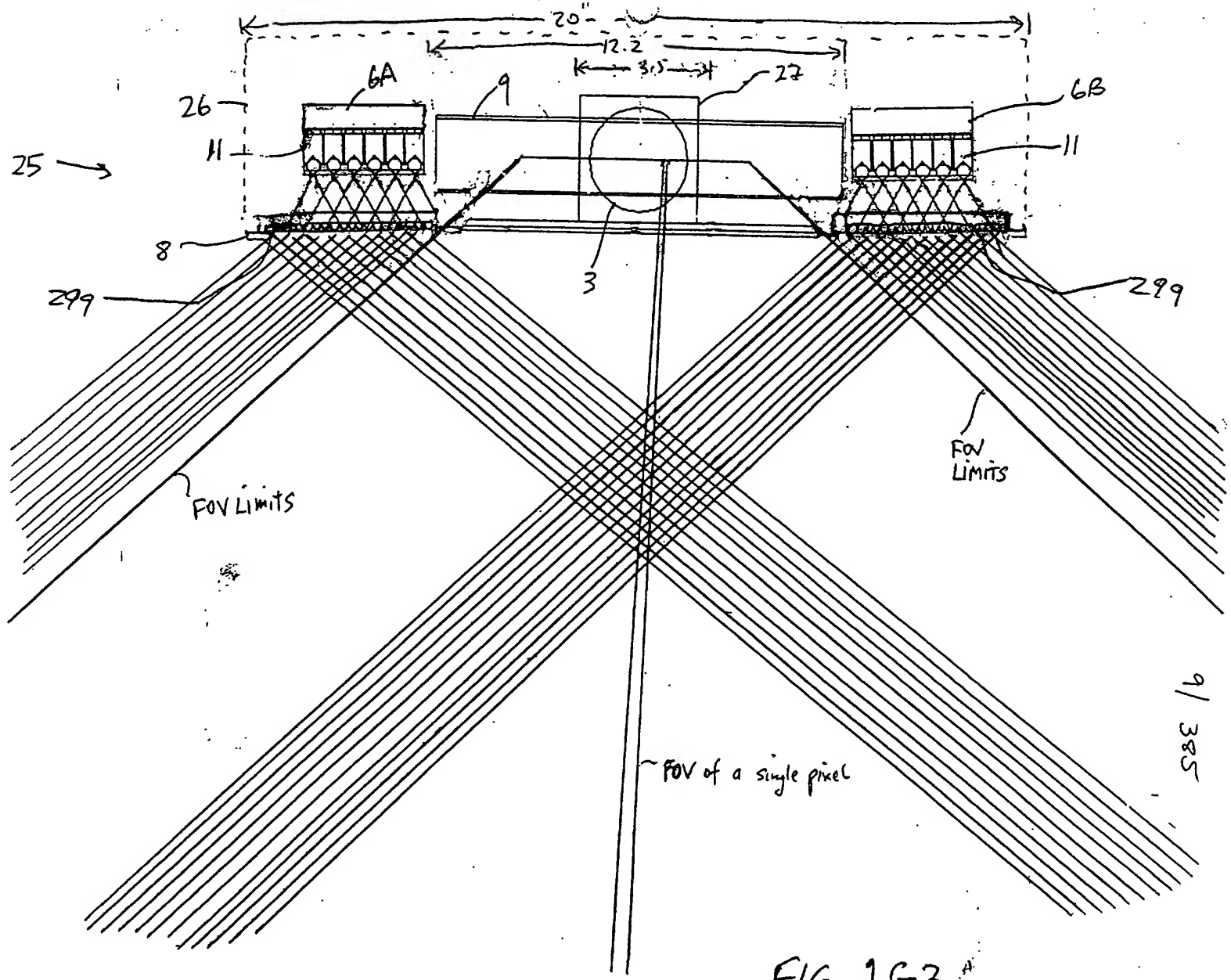

20"
12.2
3.5
6A
9
27
6B
26
11
11
25
8
3
299
299
FOV LIMITS
FOV LIMITS
FOV of a single pixel

FIG. 1G3

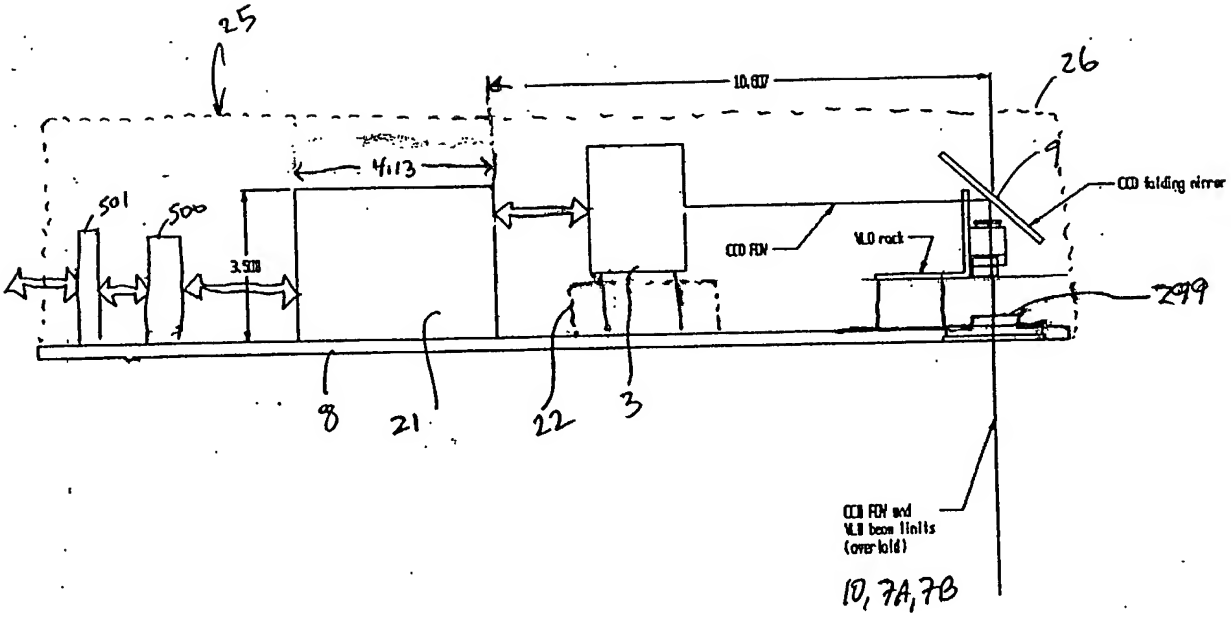

25
10.637
26
4.113
9
CCD folding mirror
501
500
3.508
CCD FDN
VLO rack
299
8
21
22
3
CCD FDN and
VLO beam limits
(over-laid)
10, 7A, 7B

FIG. 164

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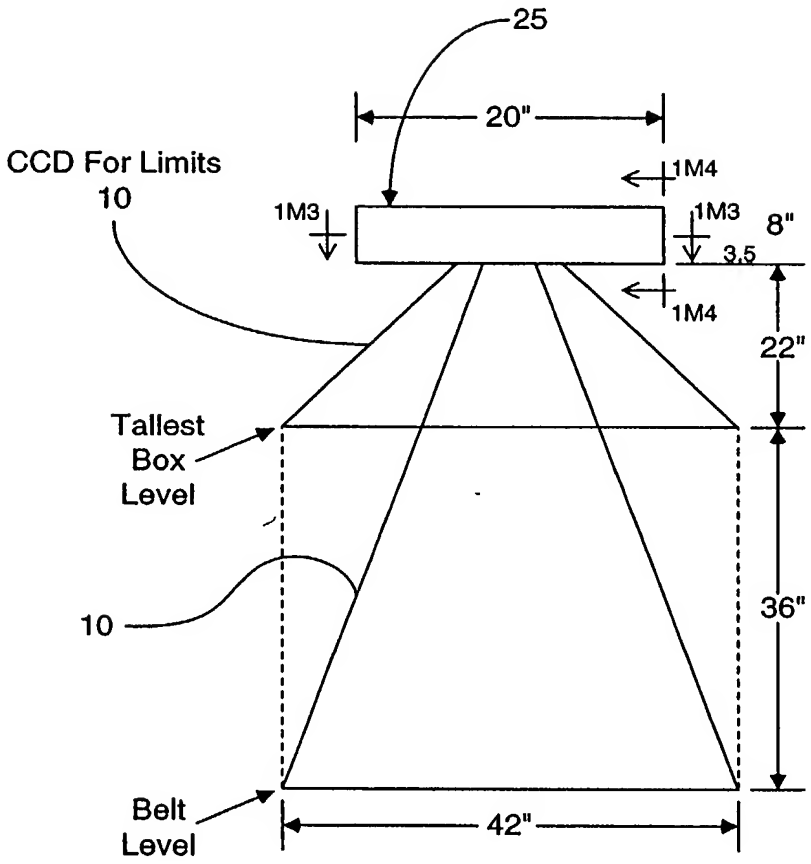

* Fixed Field Of Field

FIG. 1G5

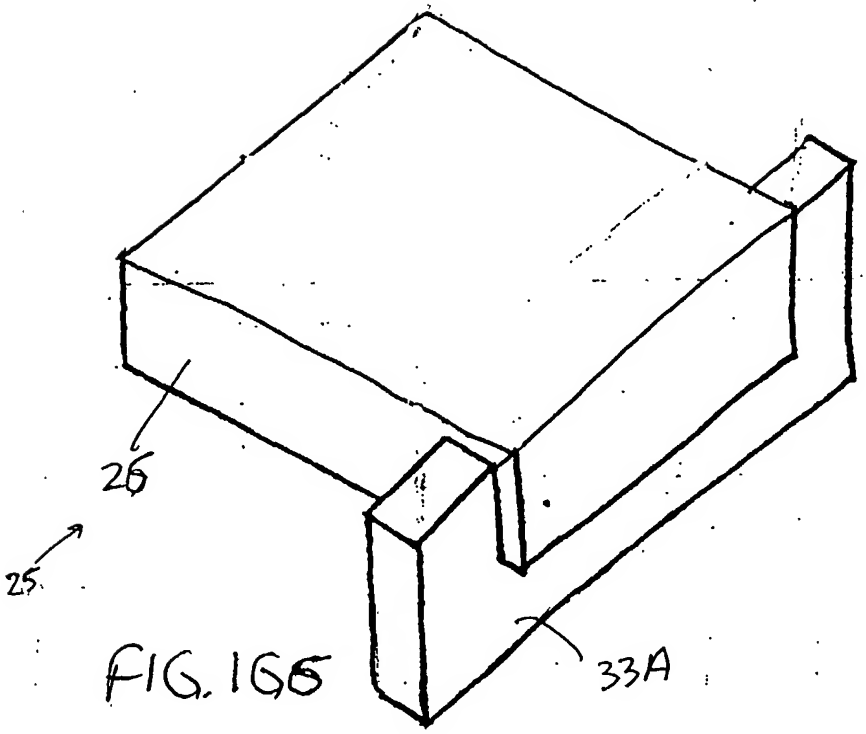

FIG. 16B

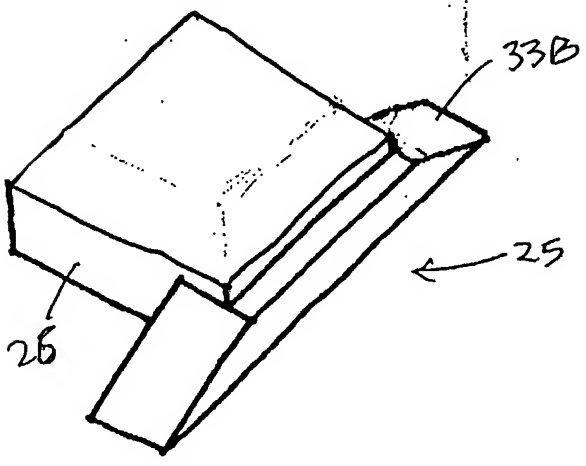

FIG. 16F

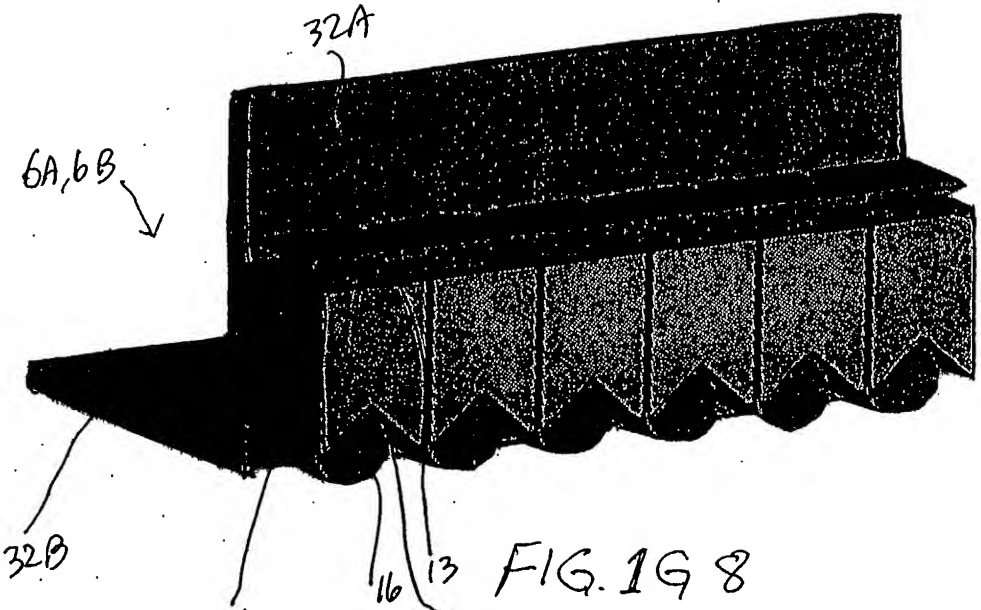

FIG. 1G 8

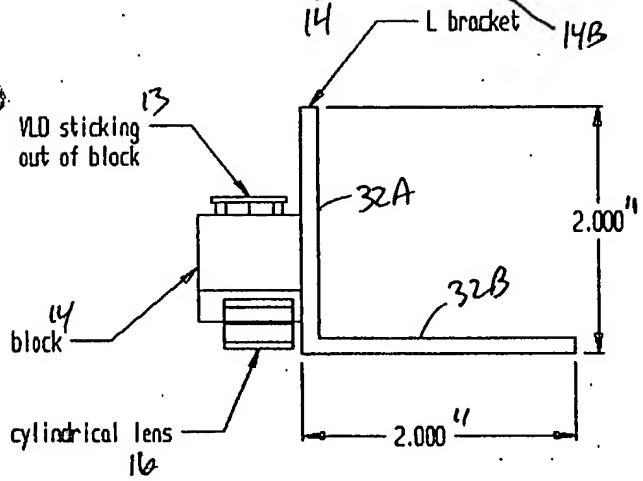

FIG. 1G. 9

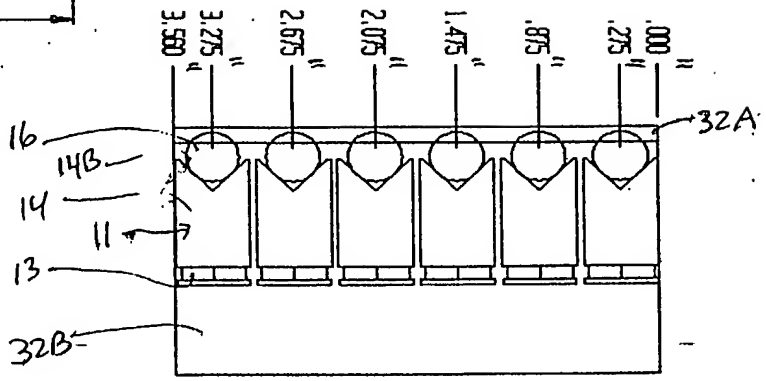

FIG. 1G10

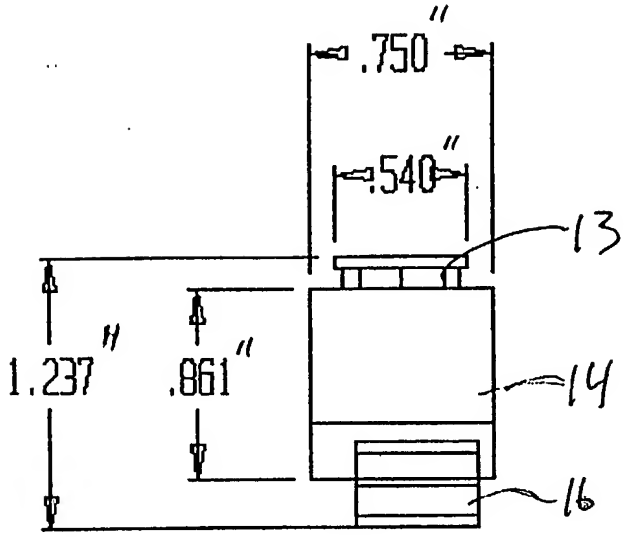

FIG. 1G11

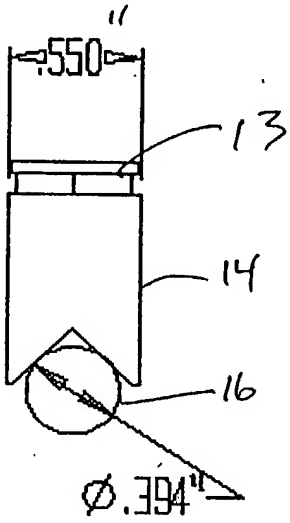

FIG. 1G12

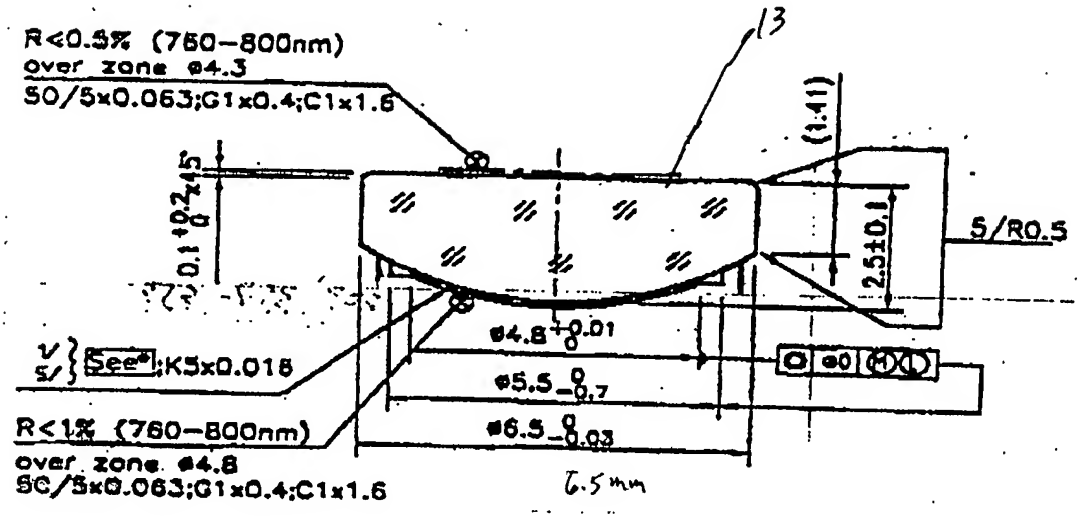

FIG. 1G 13

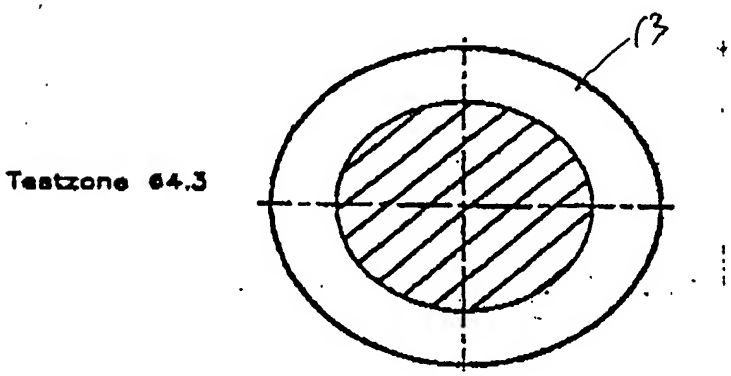

FIG. 1G 14

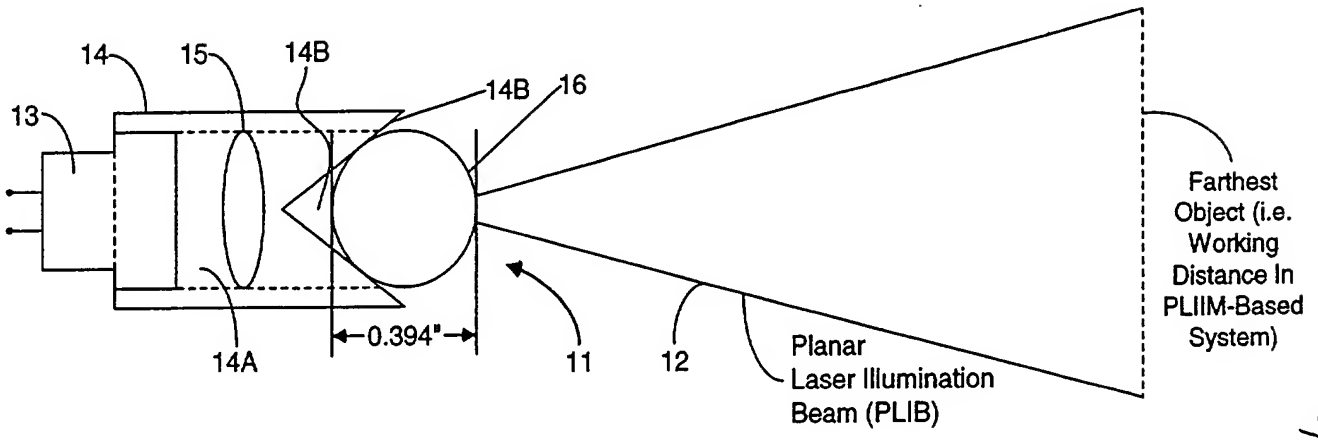

FIG. 1G15A

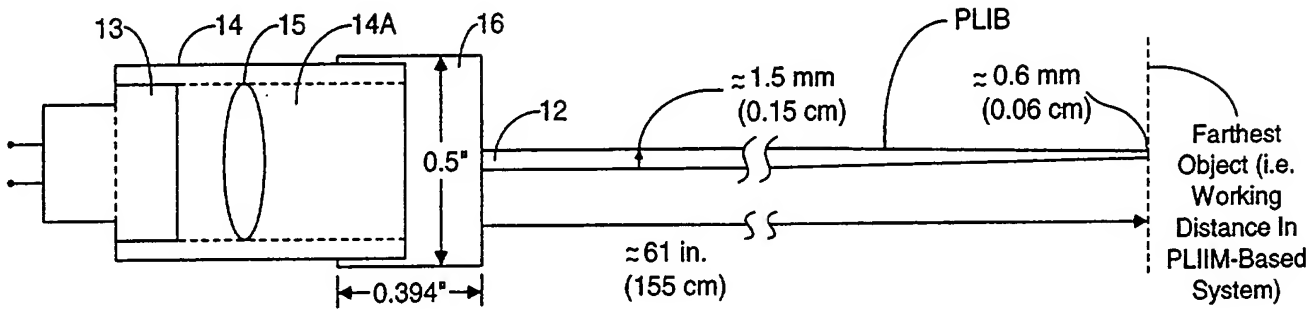

FIG. 1G15B

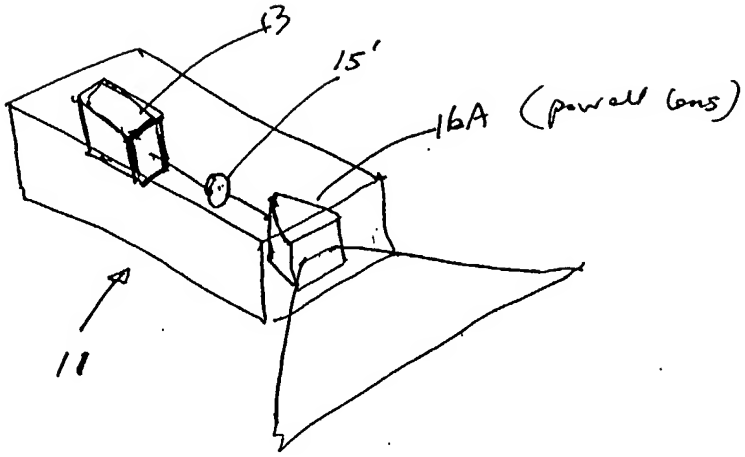

FIG. 1G.16A

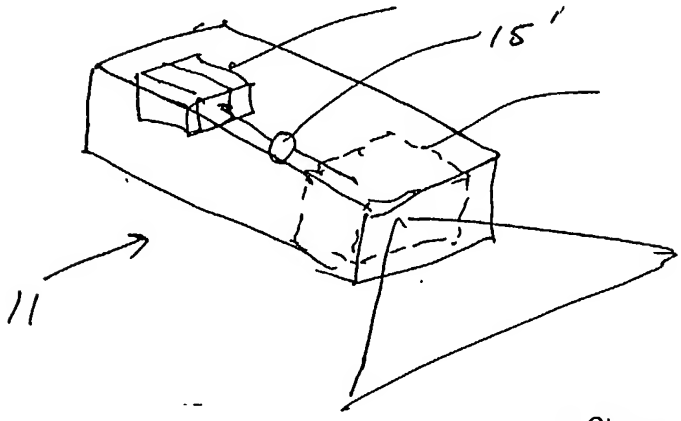

FIG. 1G16B

· PLIM w/ powell lens

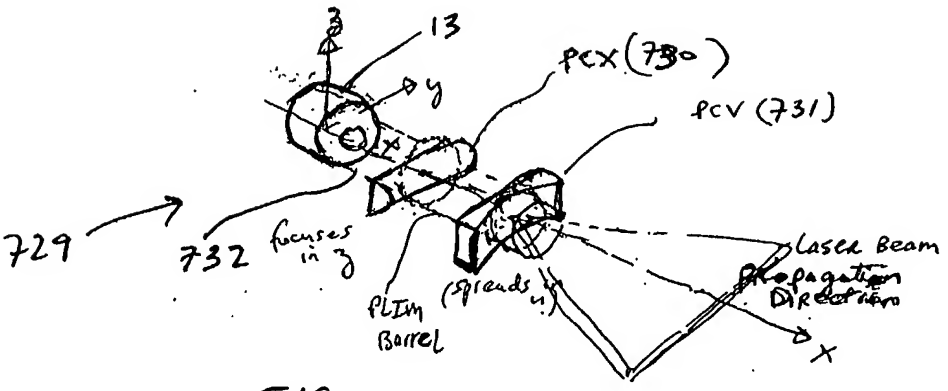

FIG. 16.17A

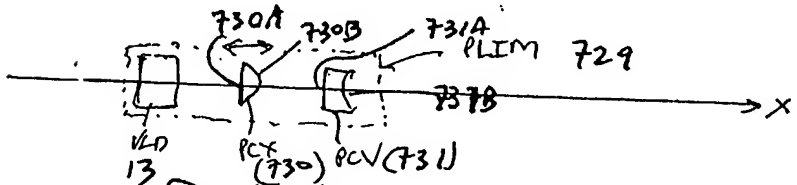

FIG. 16.17B

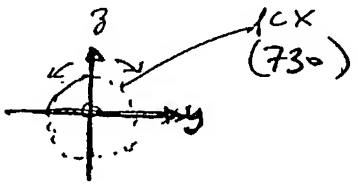

FIG. 16.17C

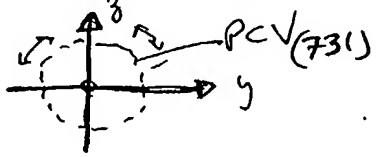

FIG. 16.17D

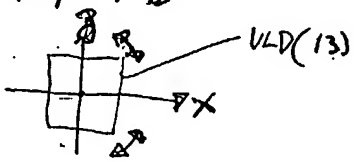

FIG. 16.17E

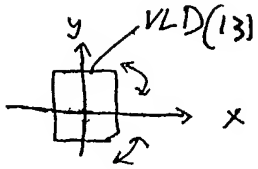

FIG. 16.17F

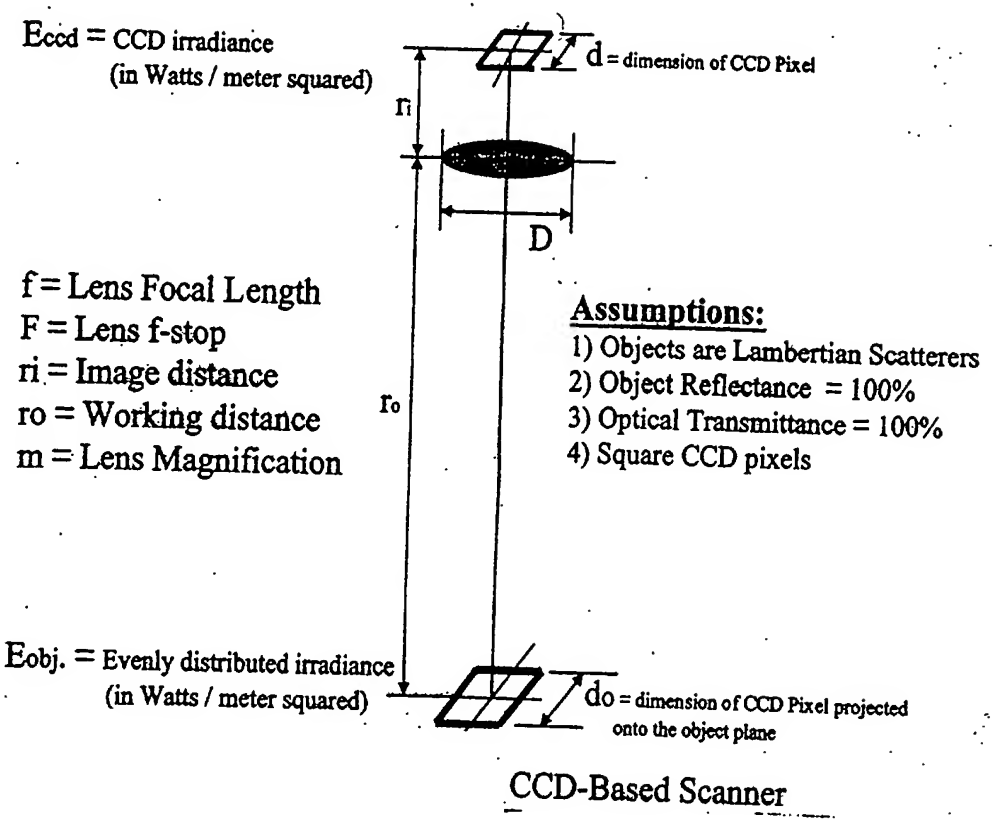
Eccd = CCD irradiance
(in Watts / meter squared)
d = dimension of CCD Pixel
ri
D
f = Lens Focal Length
F = Lens f-stop
ri = Image distance
ro = Working distance
m = Lens Magnification
ro
Assumptions:
1) Objects are Lambertian Scatterers
2) Object Reflectance = 100%
3) Optical Transmittance = 100%
4) Square CCD pixels
Eobj. = Evenly distributed irradiance
(in Watts / meter squared)
do = dimension of CCD Pixel projected
onto the object plane
CCD-Based Scanner

FIG. 1H6

FIRST GENERALIZED METHOD of Reducing Speckle-Noise Patterns at Image Detection array of the IFD Subsystem (3)

(SPMF)

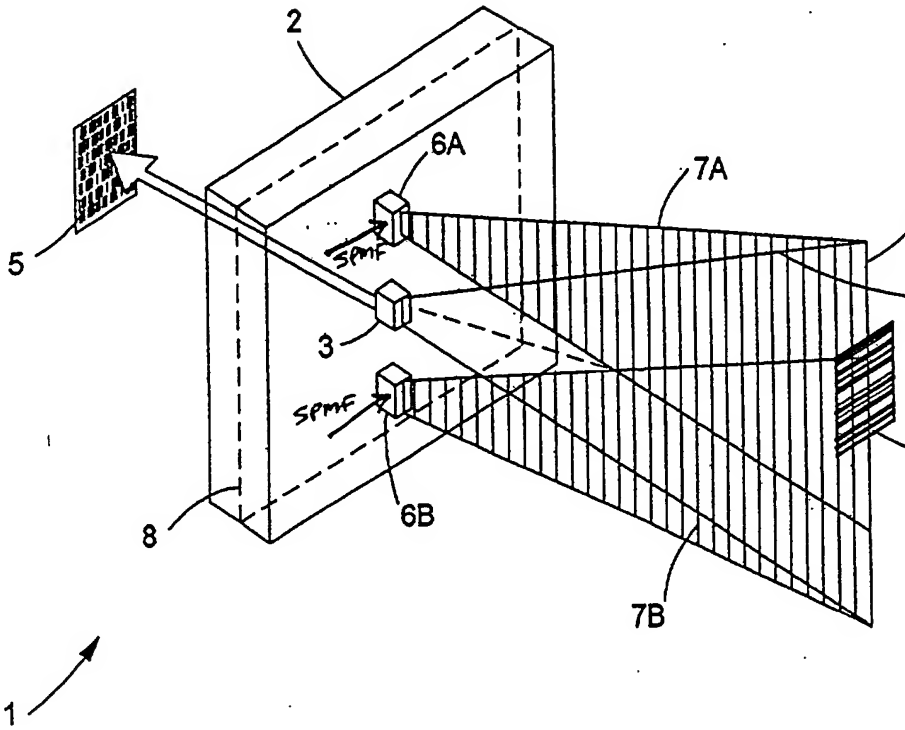

FIG. 1I1

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10/09/2001 09:22:45 PM

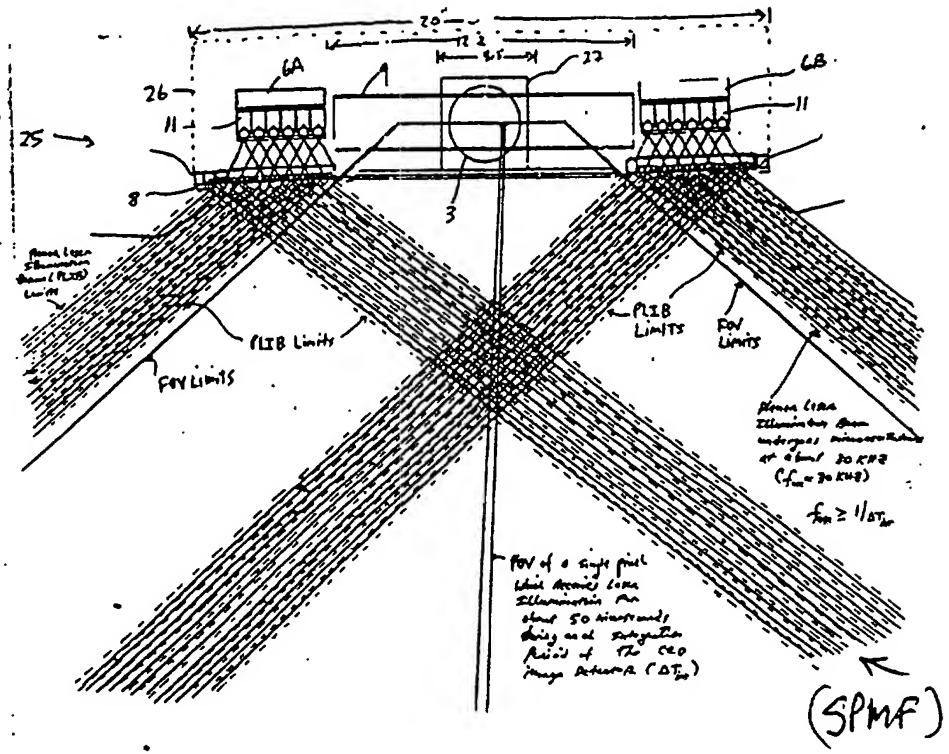

FIG. 1I2A

Prior to object Illumination

10081452 - 022502

The First Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

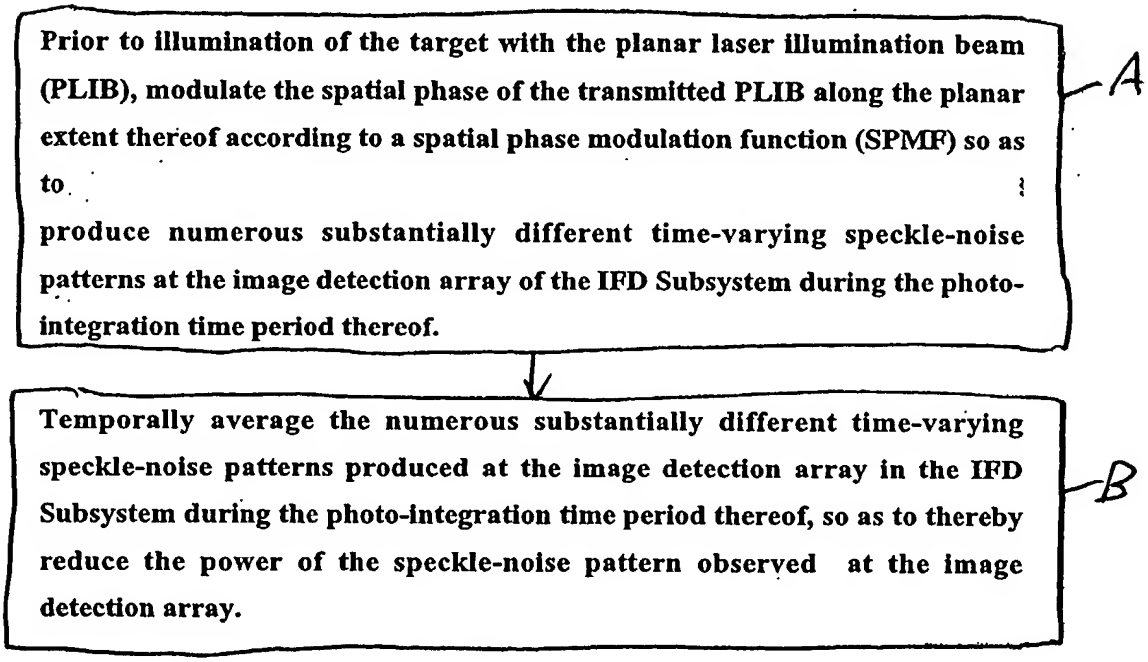

FIG. 1I2B

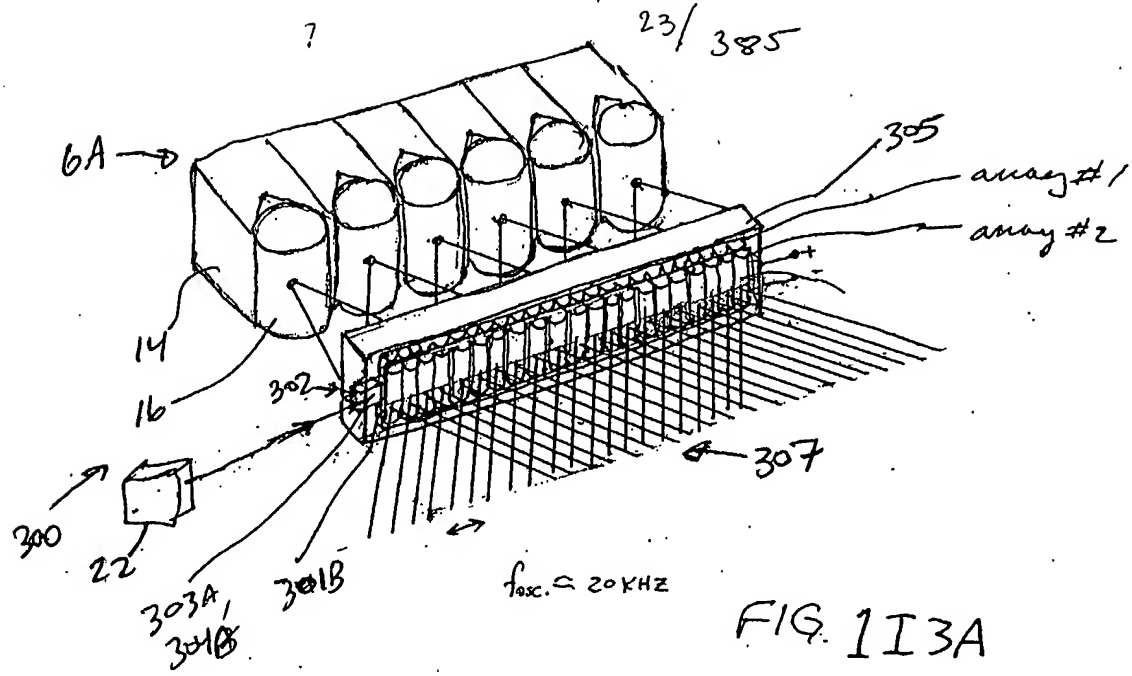

FIG. 1I3A

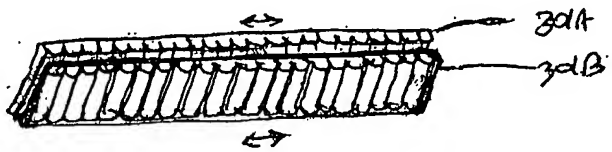

FIG. 1I3B

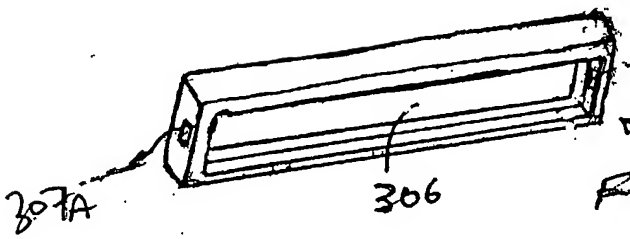

FIG. 1I3C

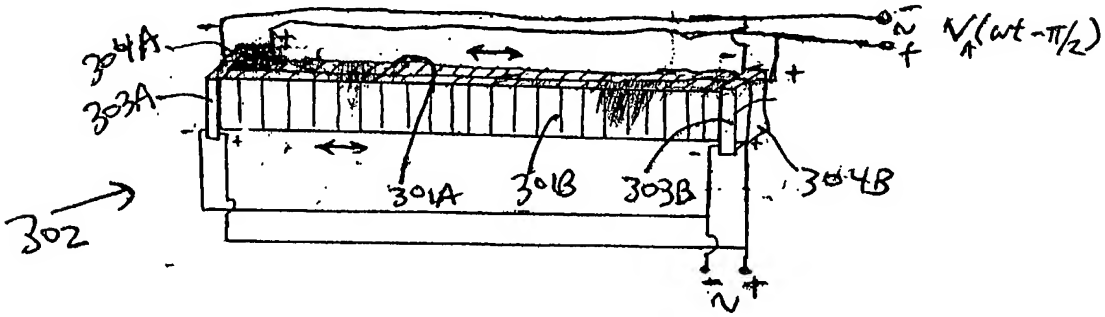

FIG. 1I3D

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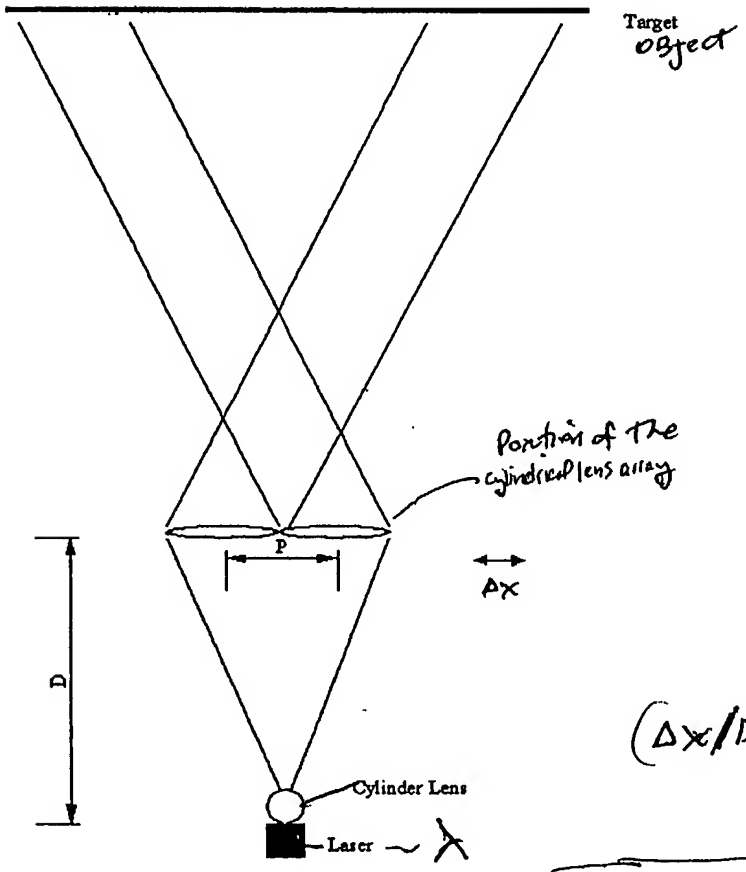


Figure 1

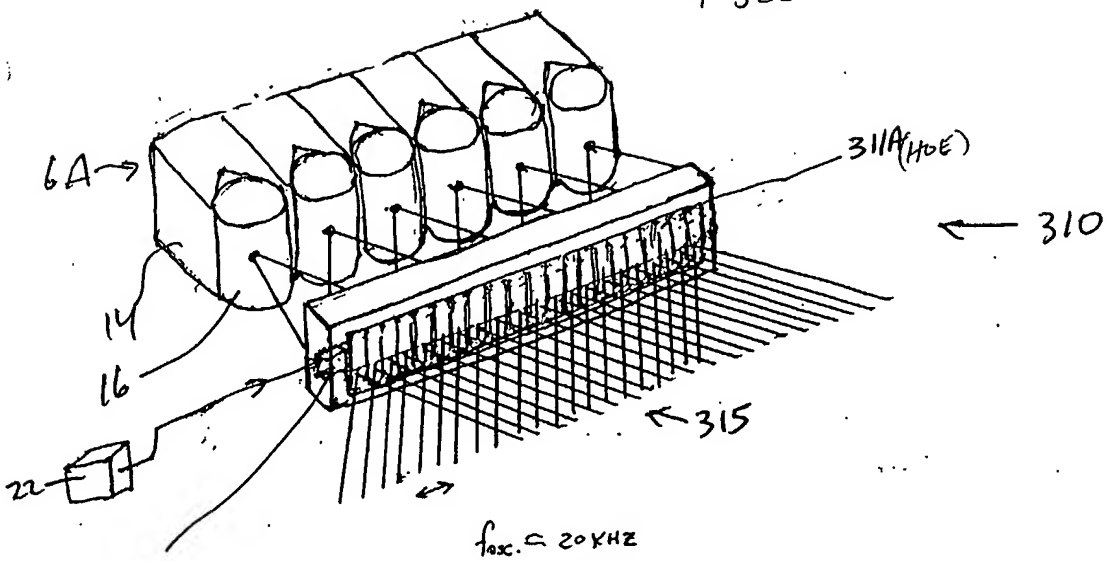
$(\Delta x / D) P = \lambda$

$$\Delta x \cong \frac{\lambda}{P} \cdot D$$

FIG. 1I3E

FIG. 1I3F

FIG 1I3G



$f_{ex.} \leq 20$ KHz

FIG 1I4A

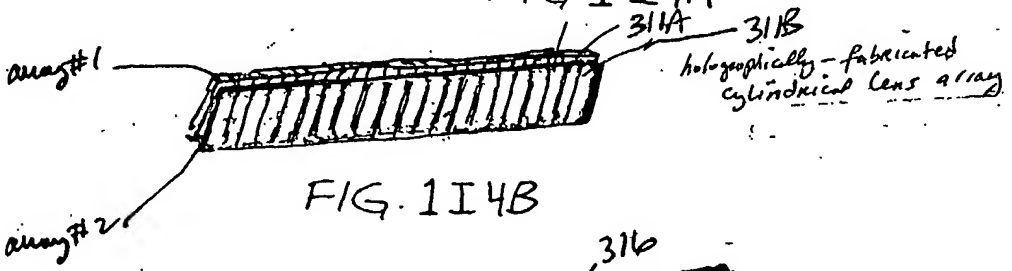


FIG. 1I4B

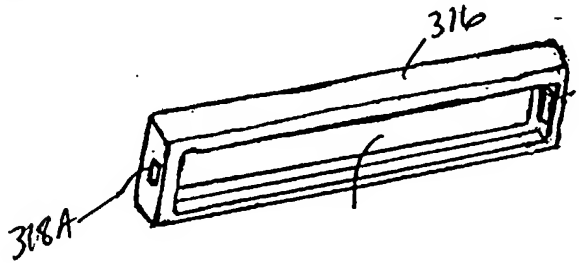


FIG 1I4C

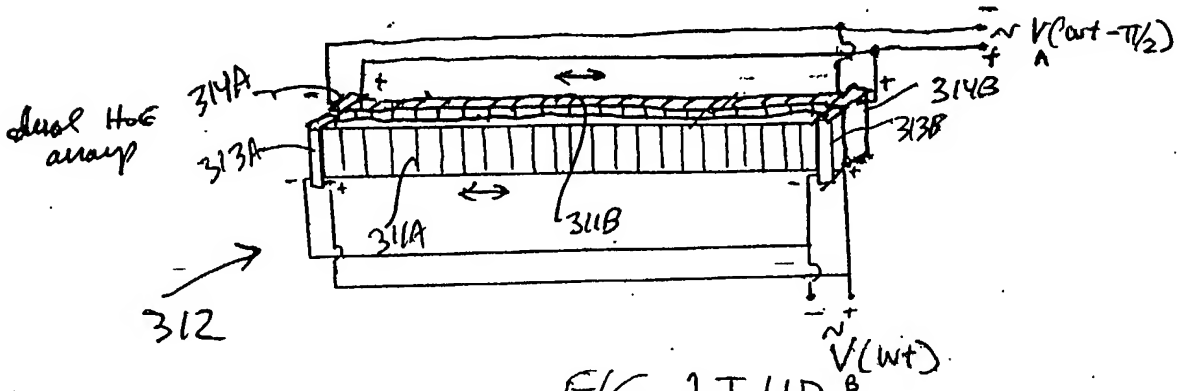


FIG. 1I4D

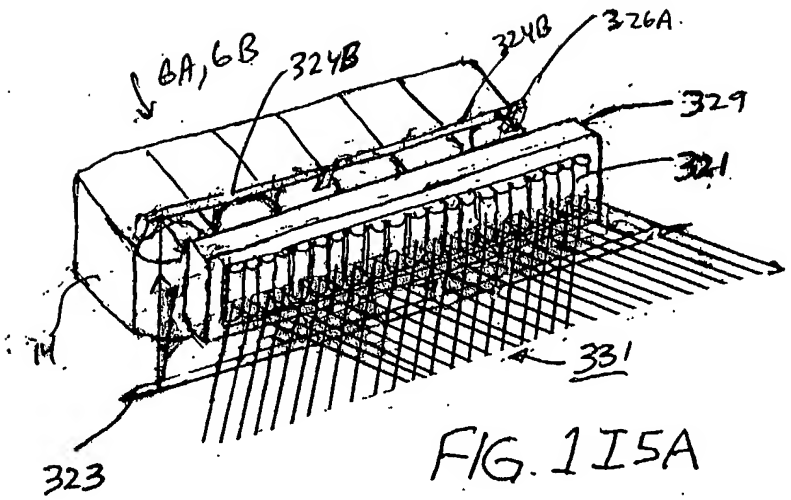


FIG. 1I5A

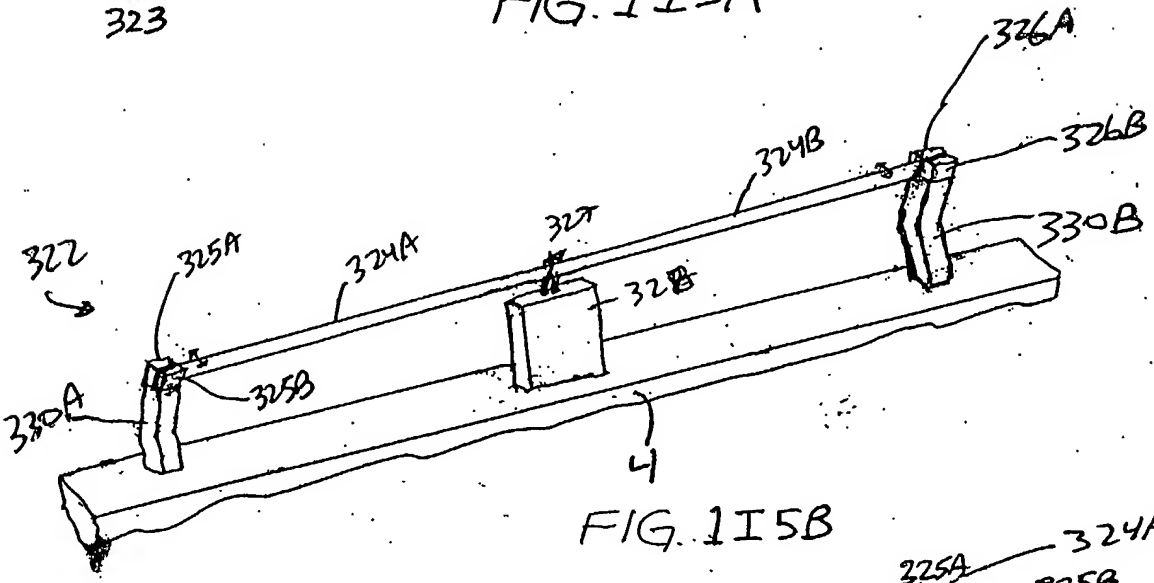


FIG. 1I5B

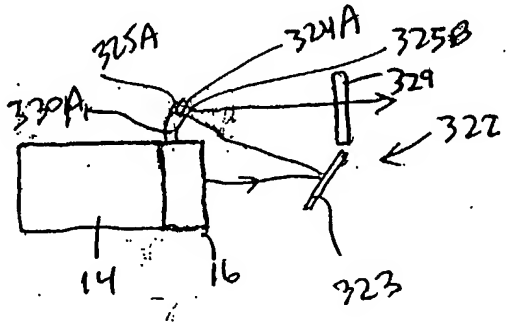


FIG. 1I5C

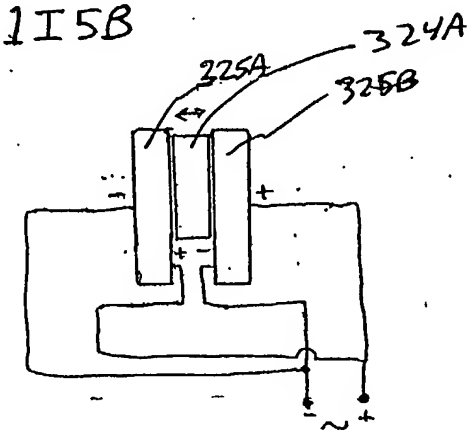


FIG. 1I5D

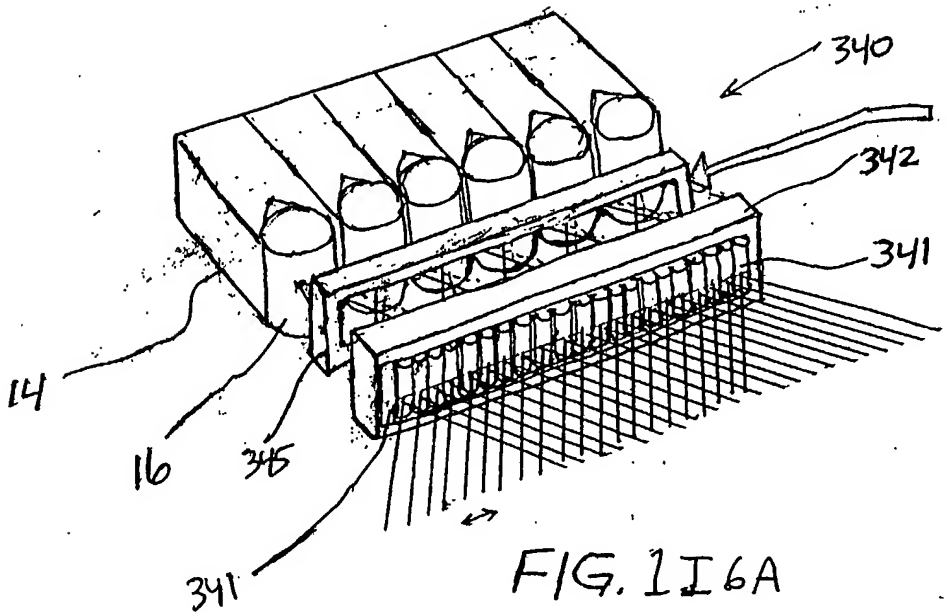


FIG. 1I6A

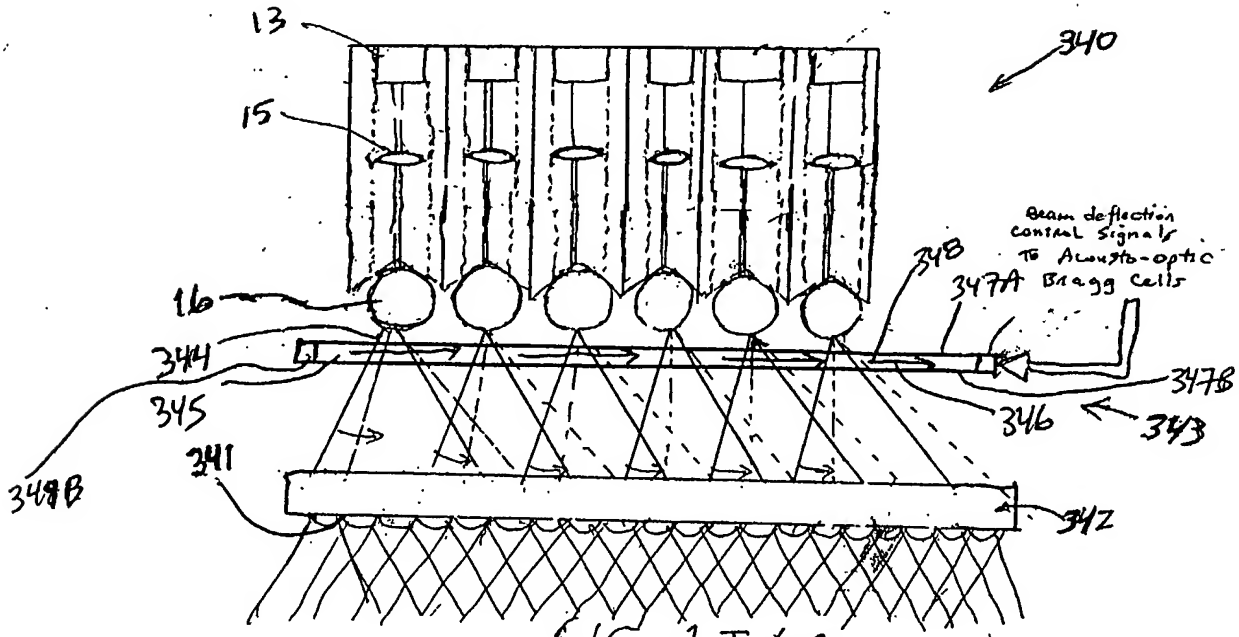


FIG. 1I6B

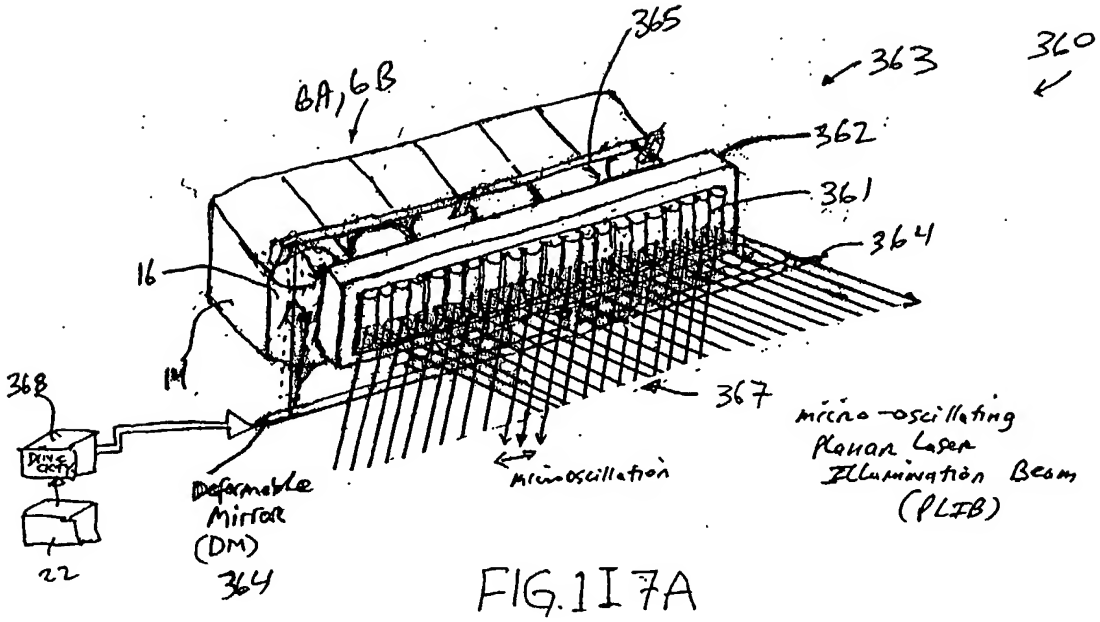


FIG.1I7A

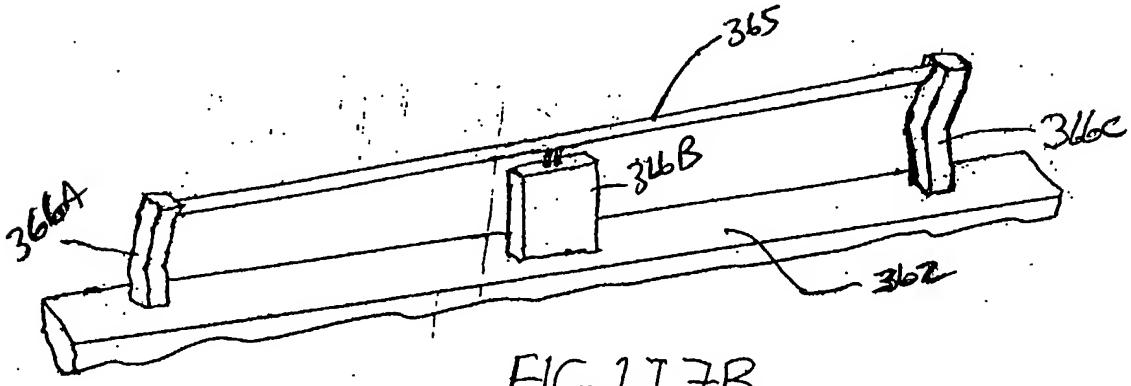


FIG.1I7B

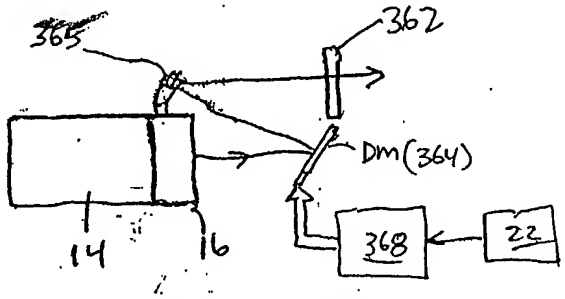


FIG.1I7C

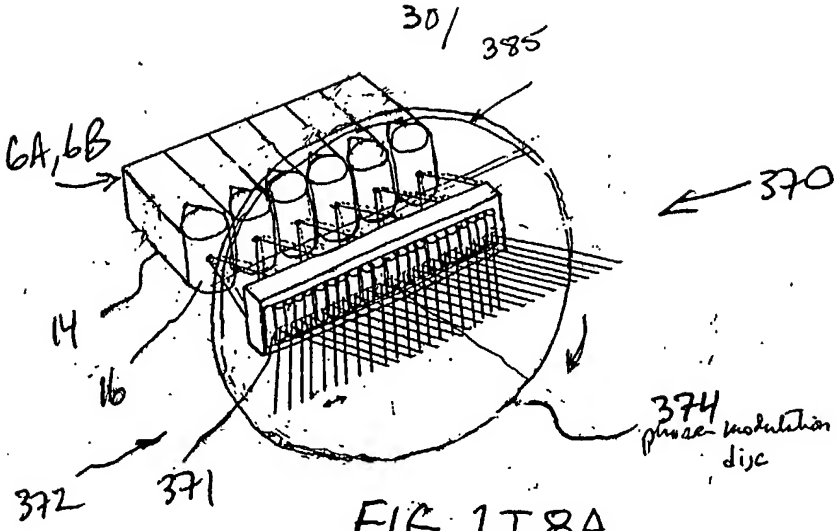


FIG. 1I8A

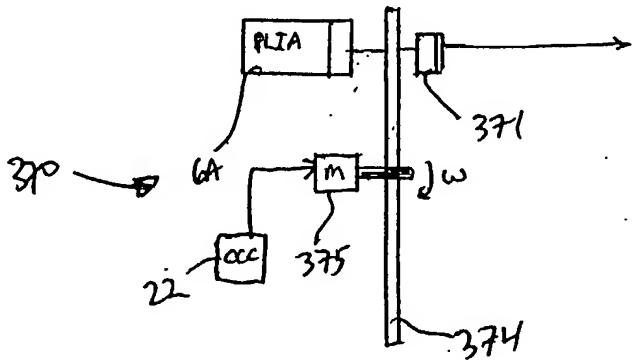


FIG. 1I8B

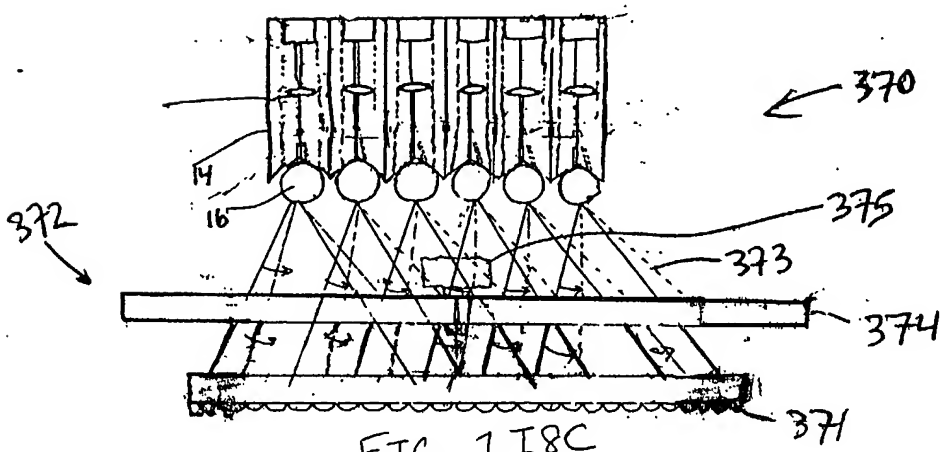


FIG. 1I8C

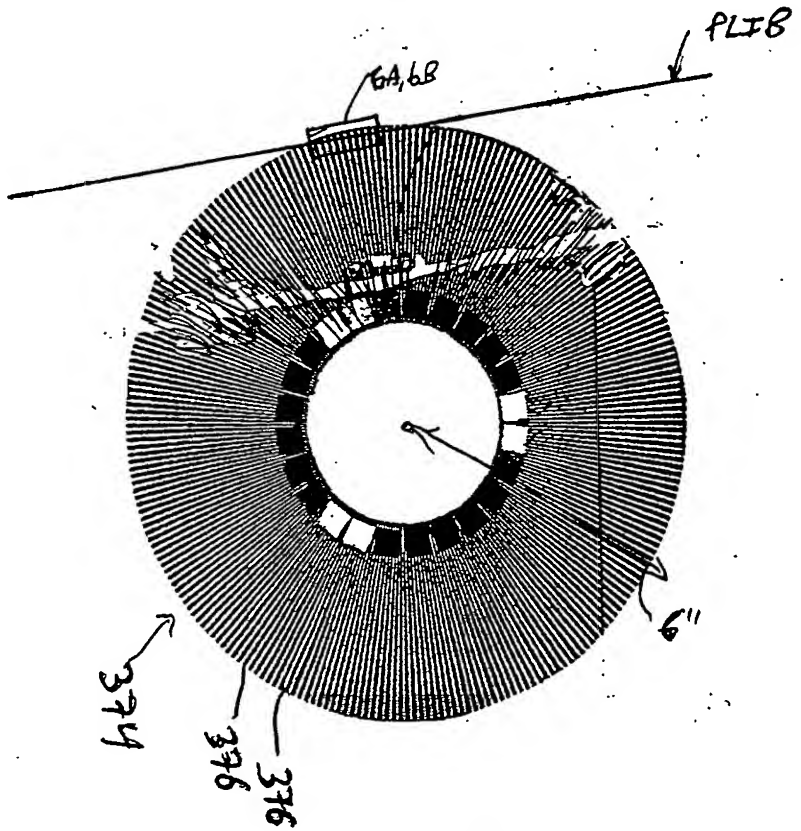


FIG. 1I8D

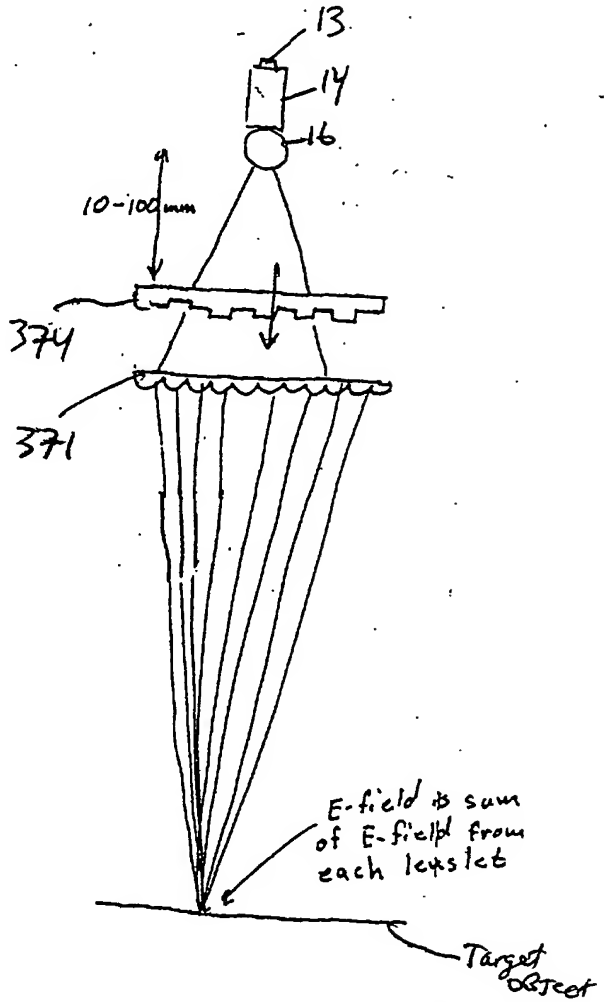


FIG 1I8E

EAST Version: 2.2.3.0

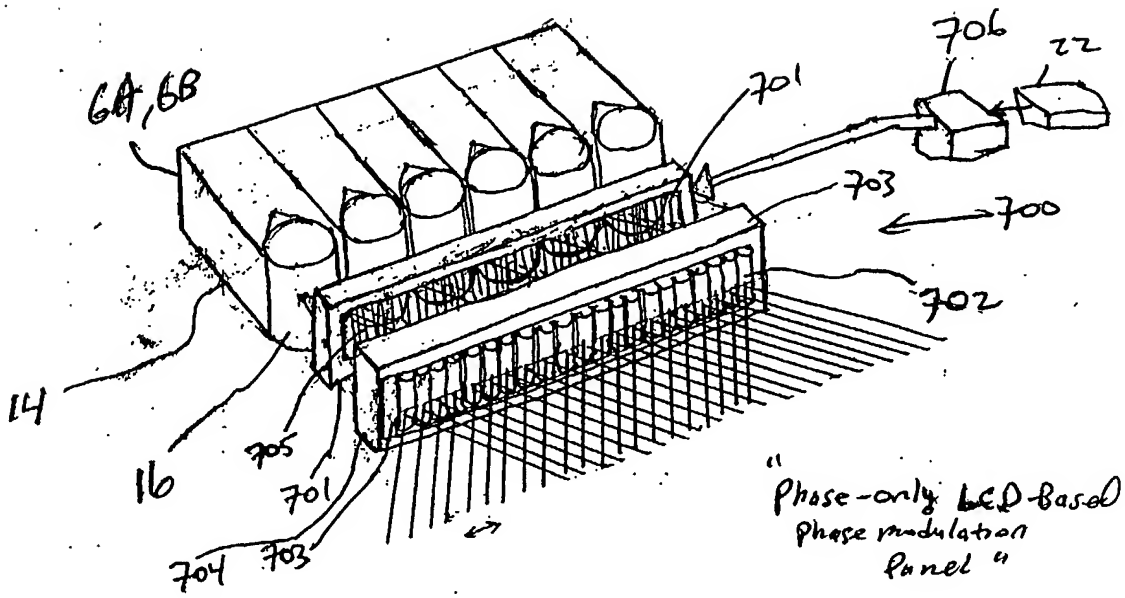


FIG. 1I8F

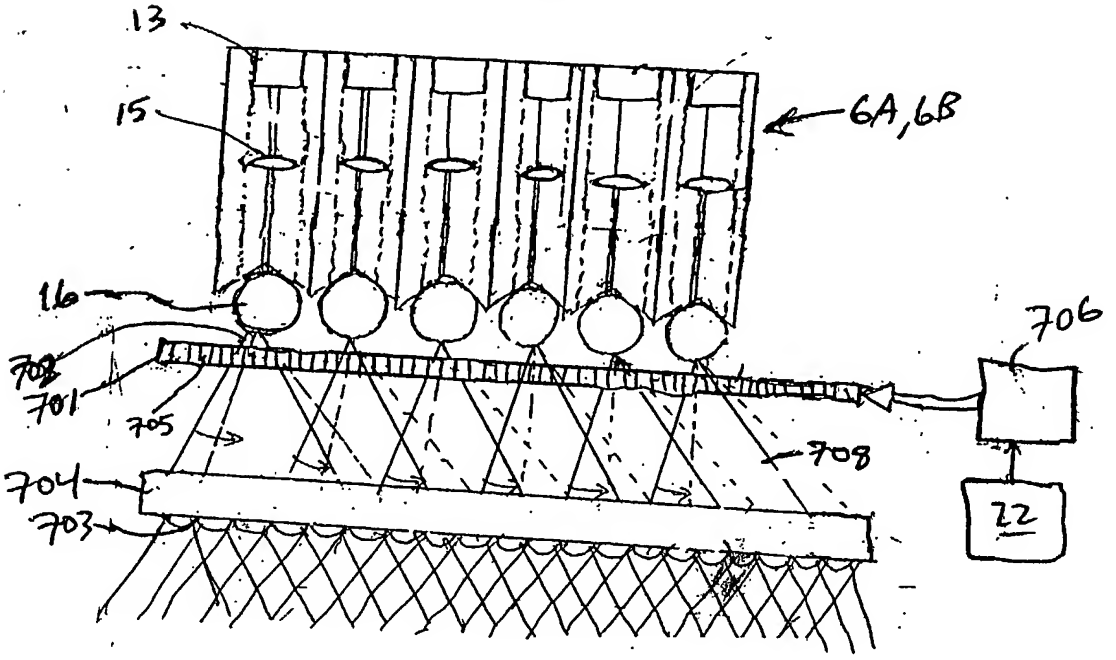


FIG. 1I8G

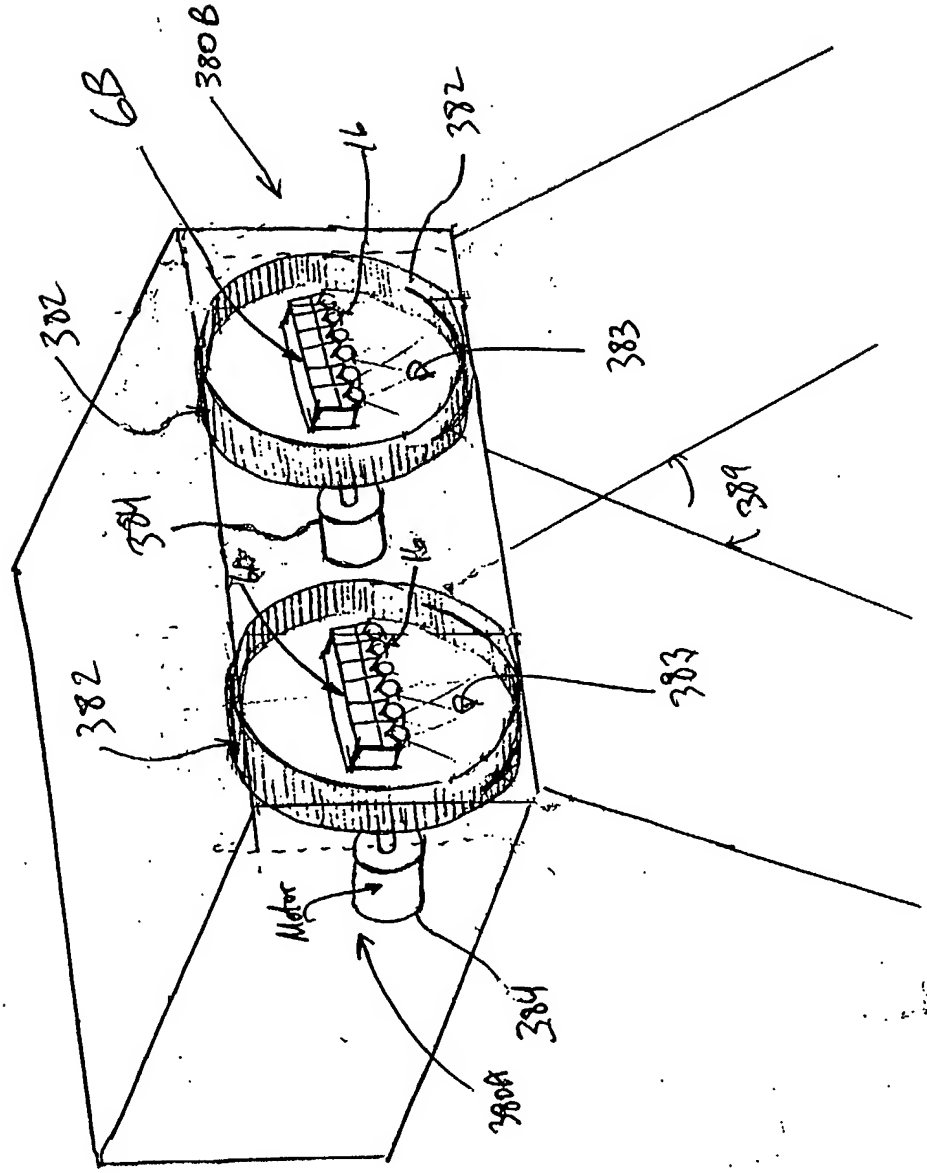


FIG. 11A

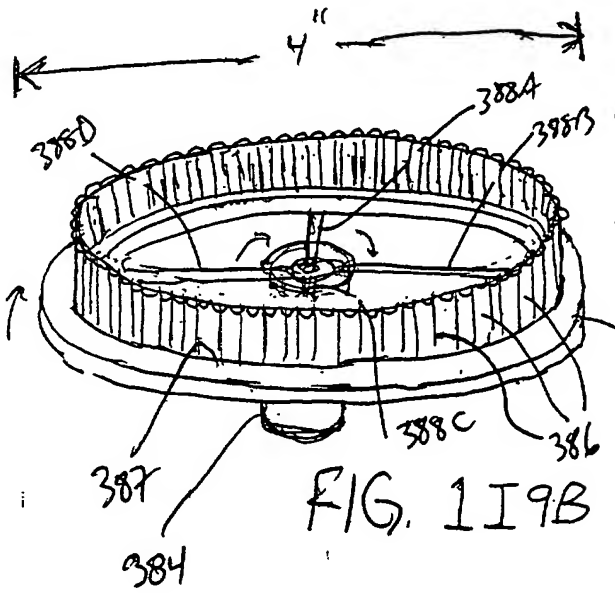


FIG. 11 9B

optical specifications:

- 30 cylindrical lens (lines) per linear inch
- focal length ≈ 2.0 millimeters
- diameter of lenticular carousel ≈ 4 inches
- acrylic material

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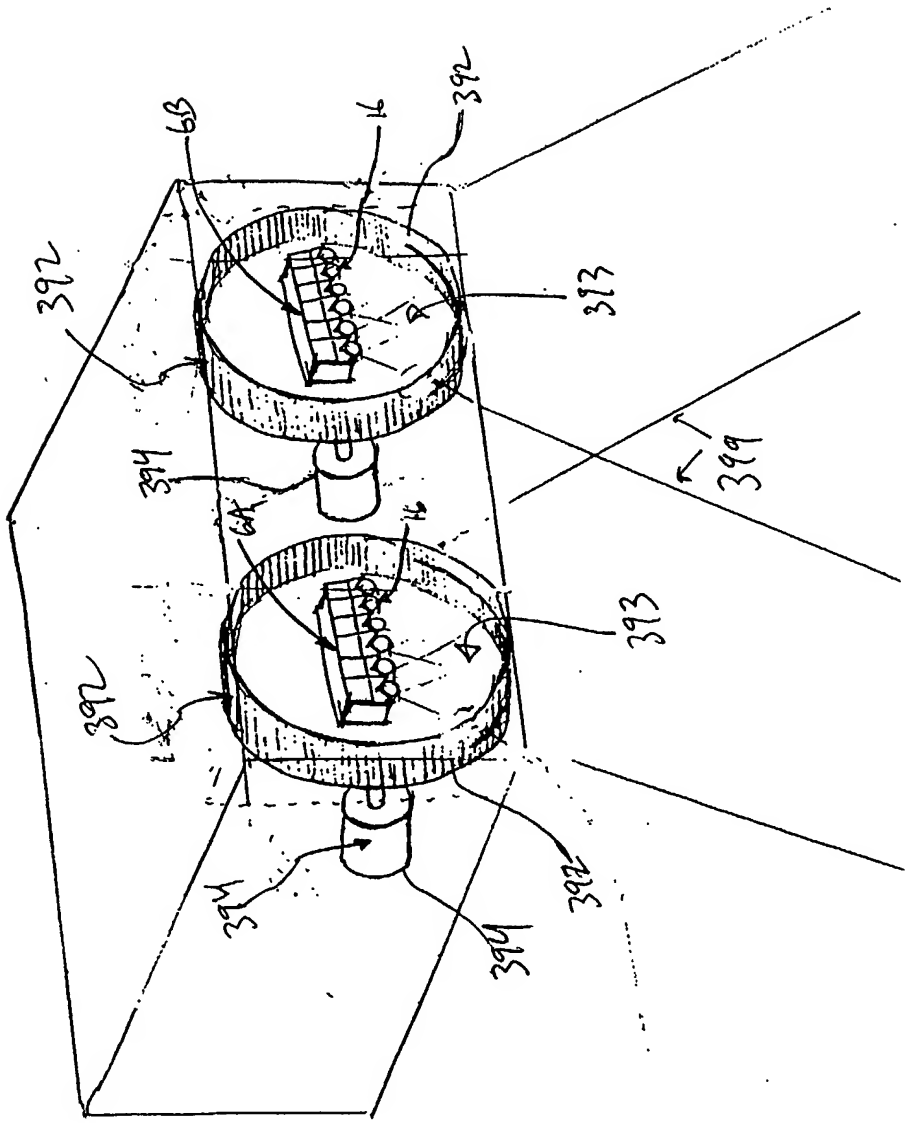

FIG. 11 10A

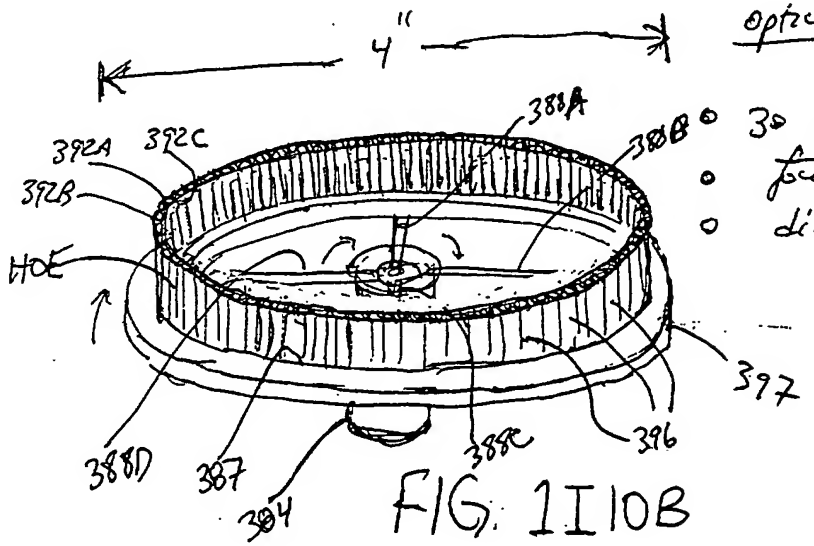

FIG. 11 10B

optical specifications:

- 30 cylindrical lens (lines) per linear inch
- focal length ≈ 2.0 millimeters
- diameter of holistic carousel ≈ 4 inches

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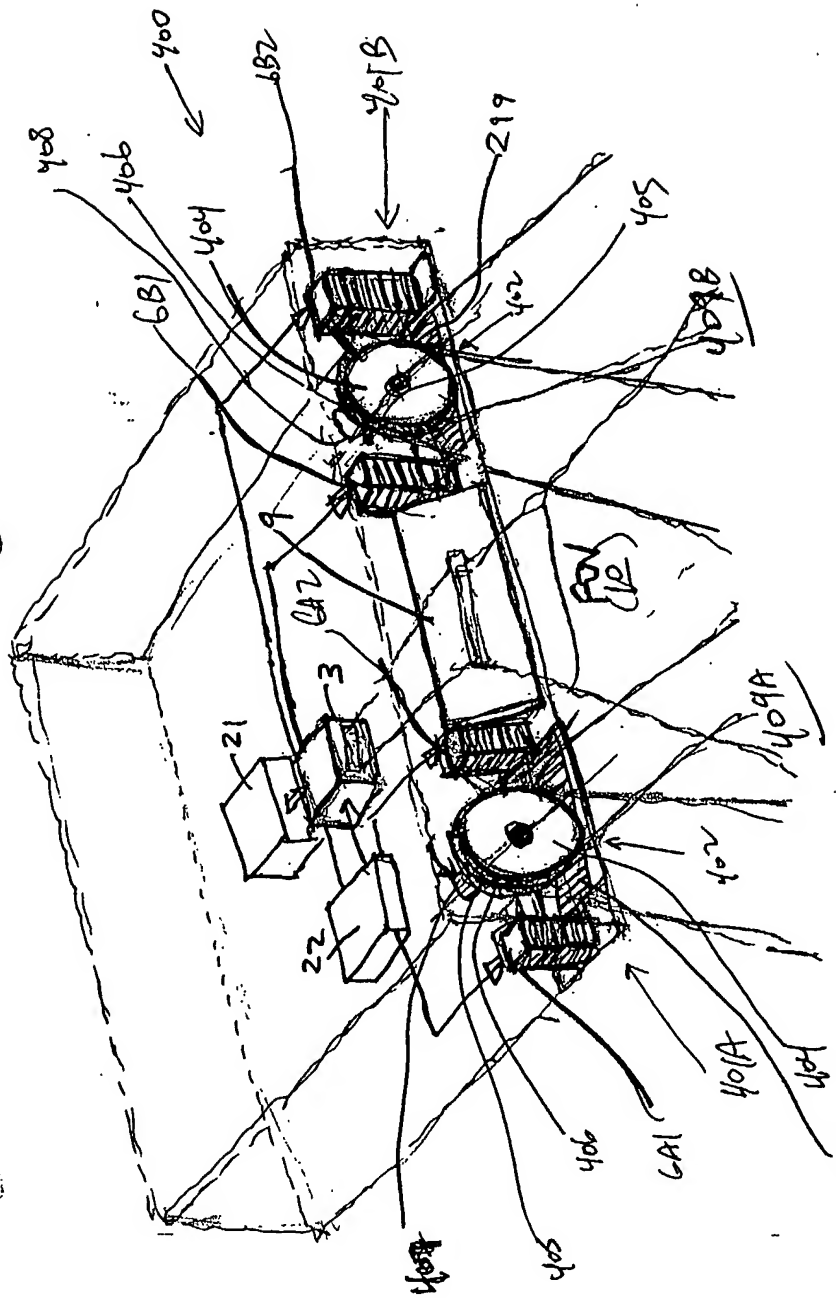
400
187
404B
219
405
402
404B
404A
409A
404
406
401
299
404
405
406
401
404A
299
404
409B
409A
404B
187
189
404
406
402
21
3
22

FIG. 11IA

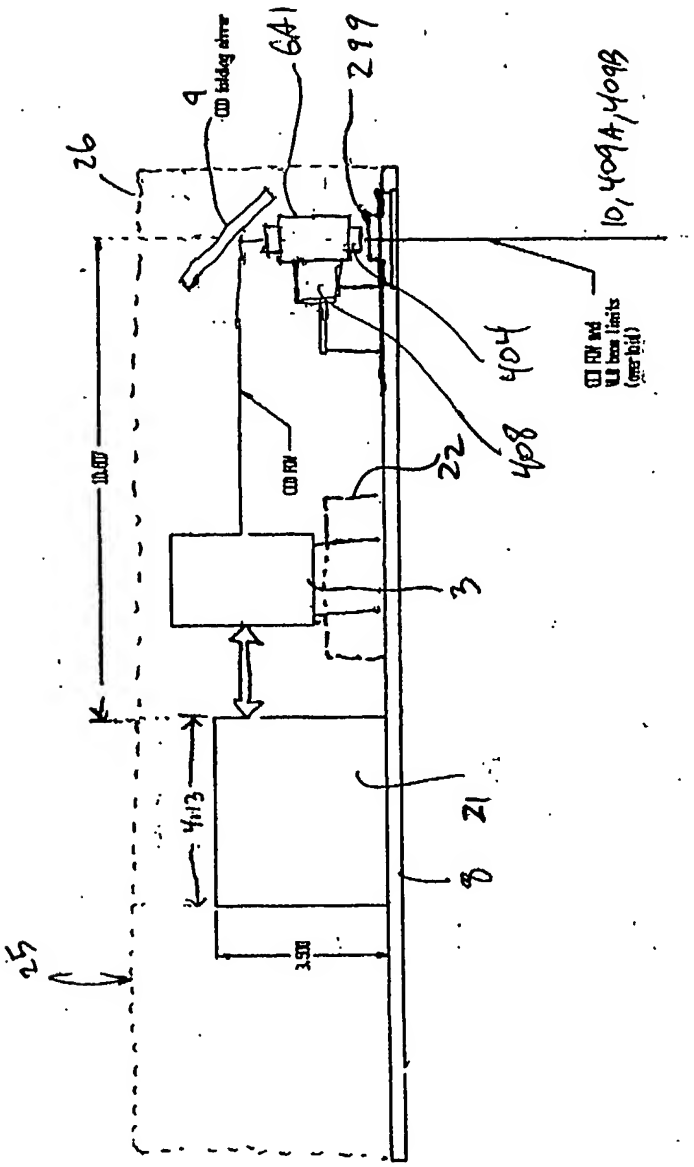

FIG 11B

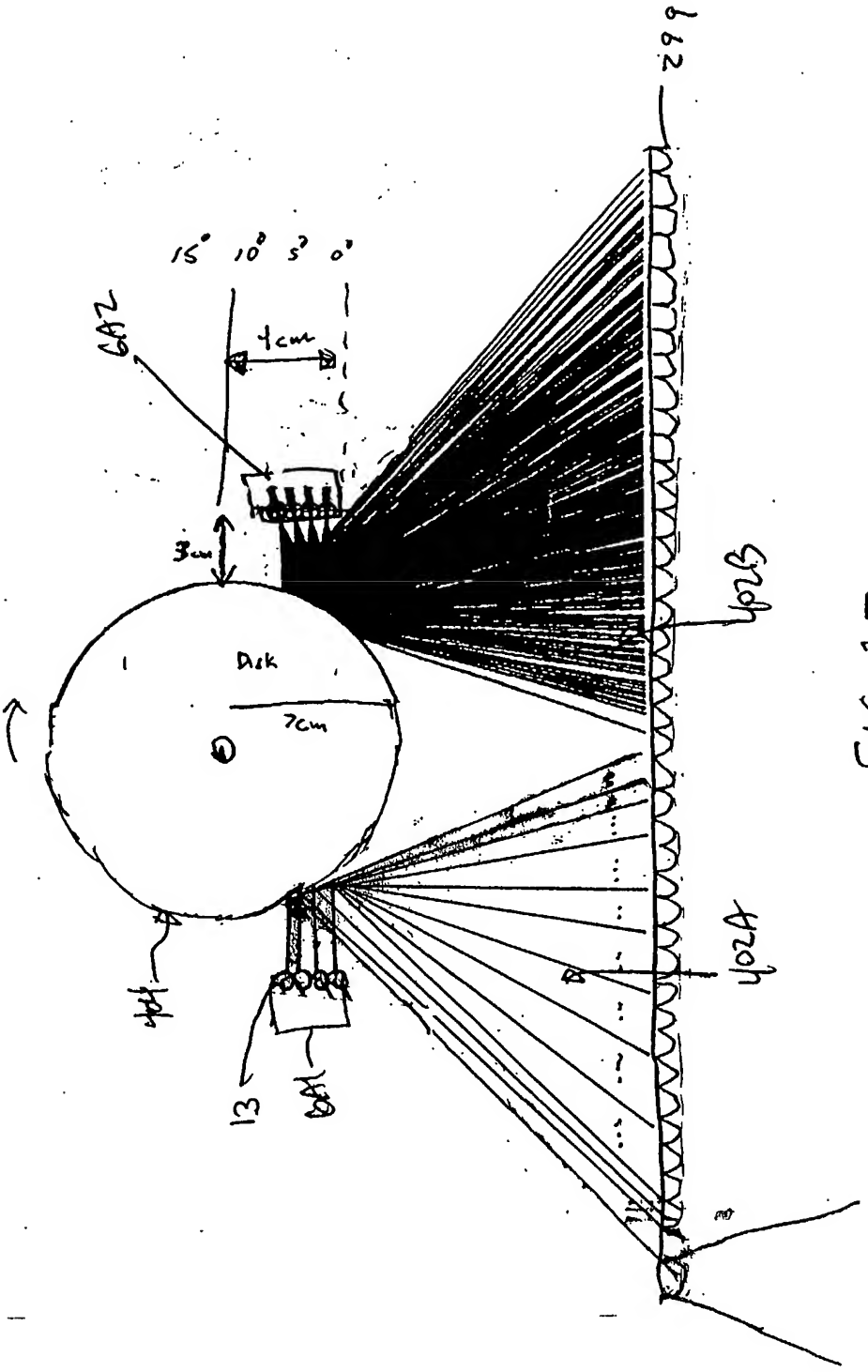

FIG. 1III C

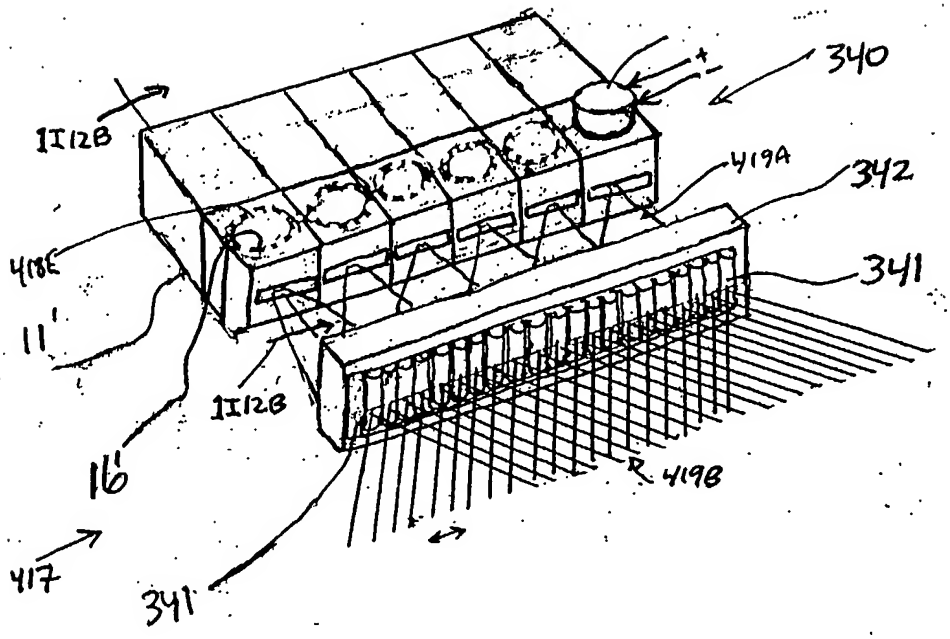

FIG. 1I12A

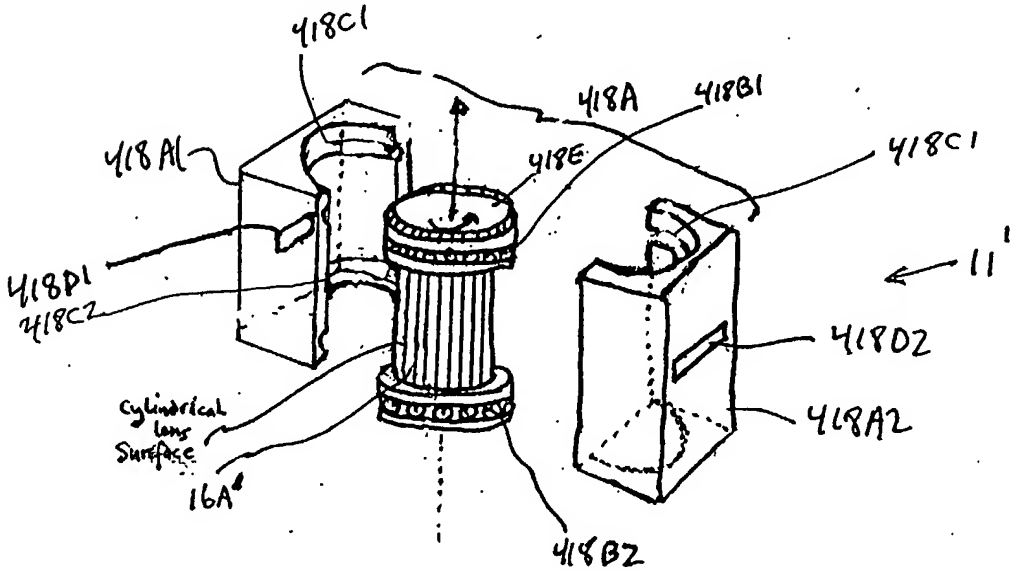

FIG. 1I12B

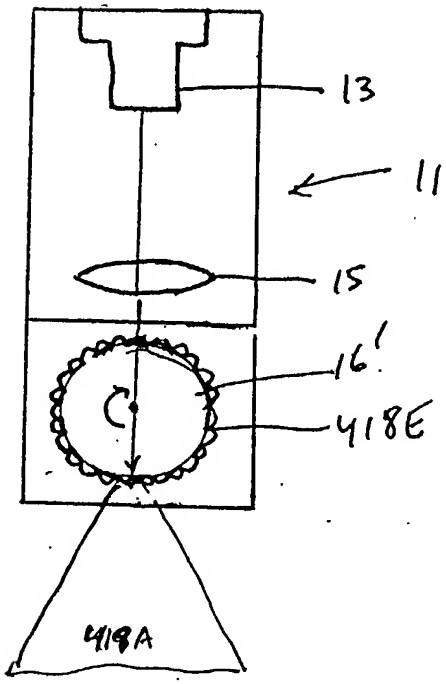

FIG. 11 12C

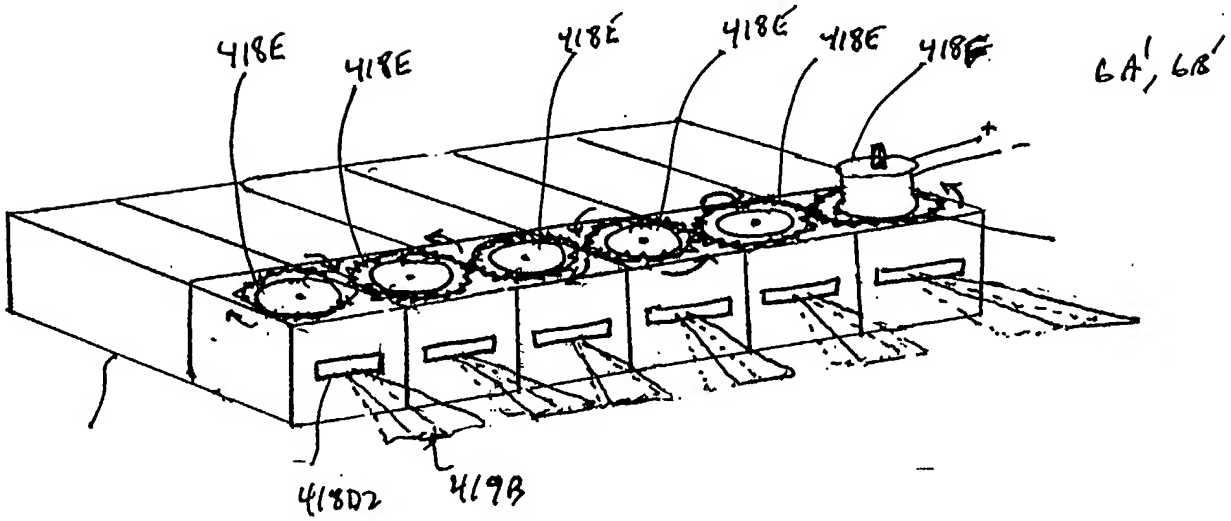

FIG. 11 12D

Second Generalized Method of Reducing Speckle-Noise Patterns at Image Detection Array of the IFD Subsystem (3)

(IIMF)

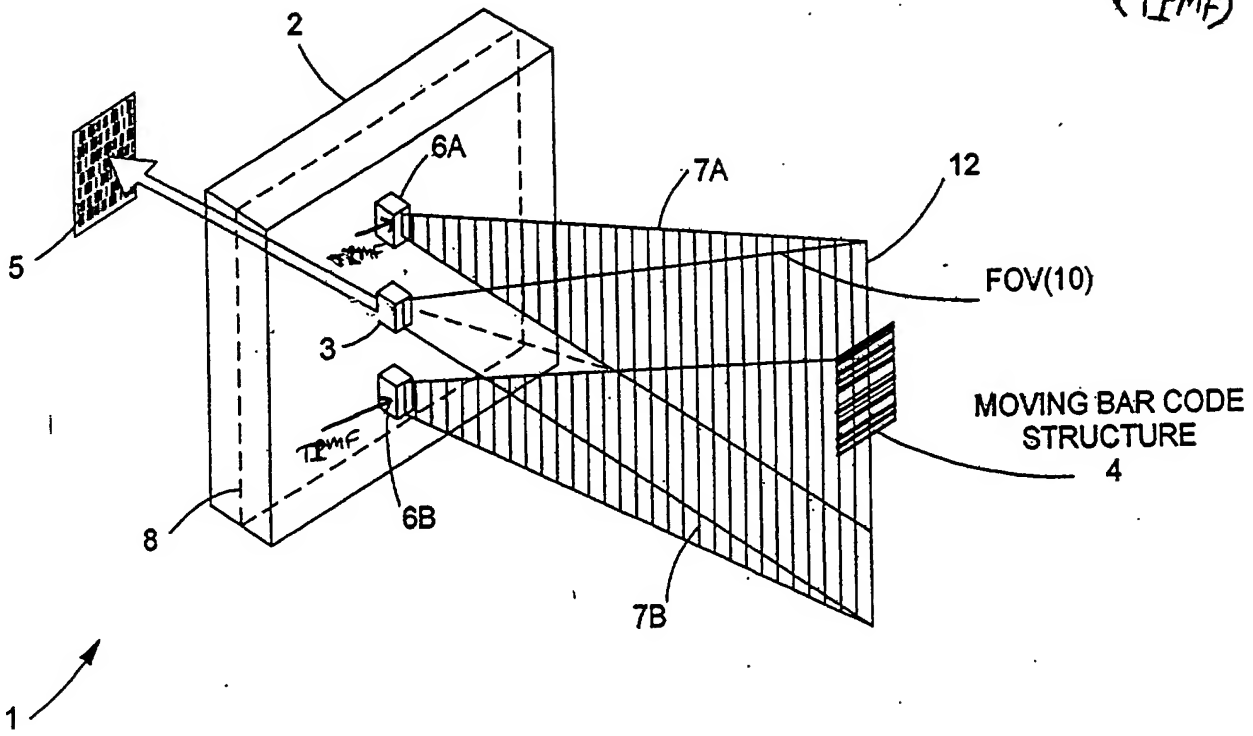

FIG. II 13

20040228210 2004-09-16

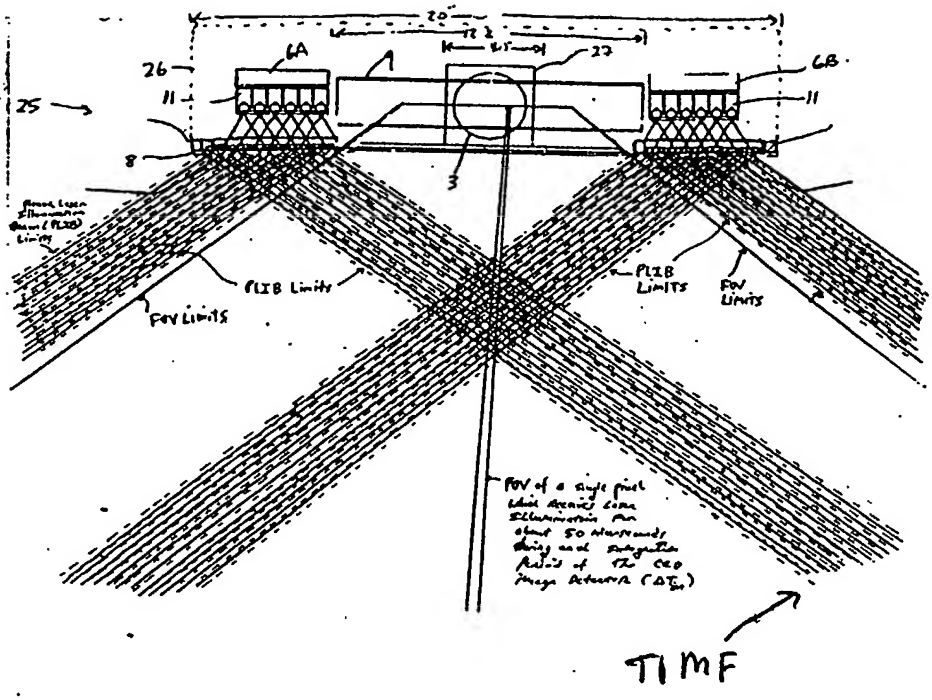
20"
6A
6B
22
26
11
25
8
3
FLIB Limits
FOV Limits
FOV of a single pixel
TIMF

FIG. 1I 13A

The Second Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

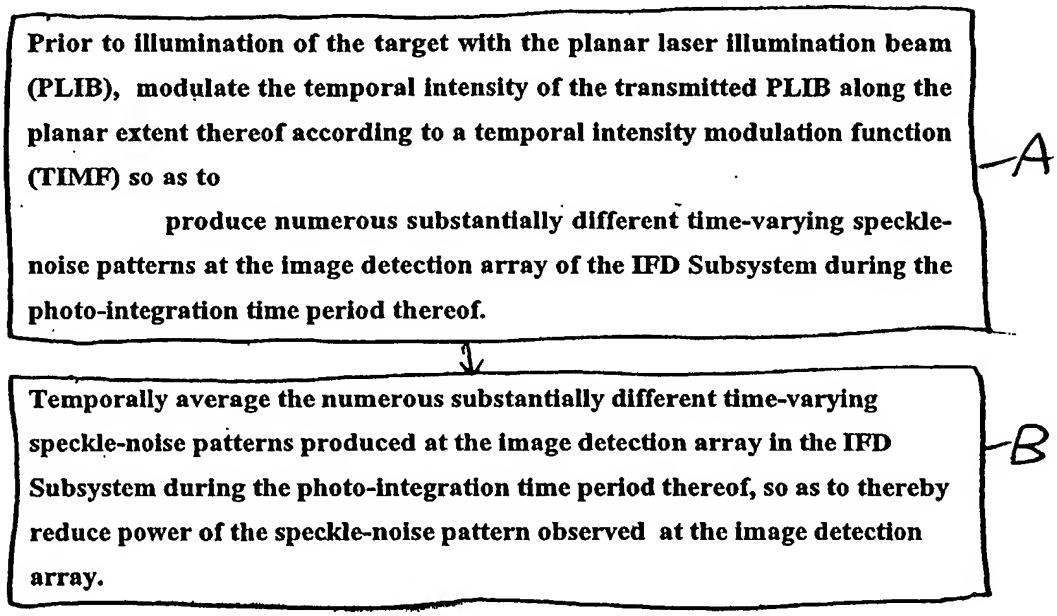

FIG. 1I13B

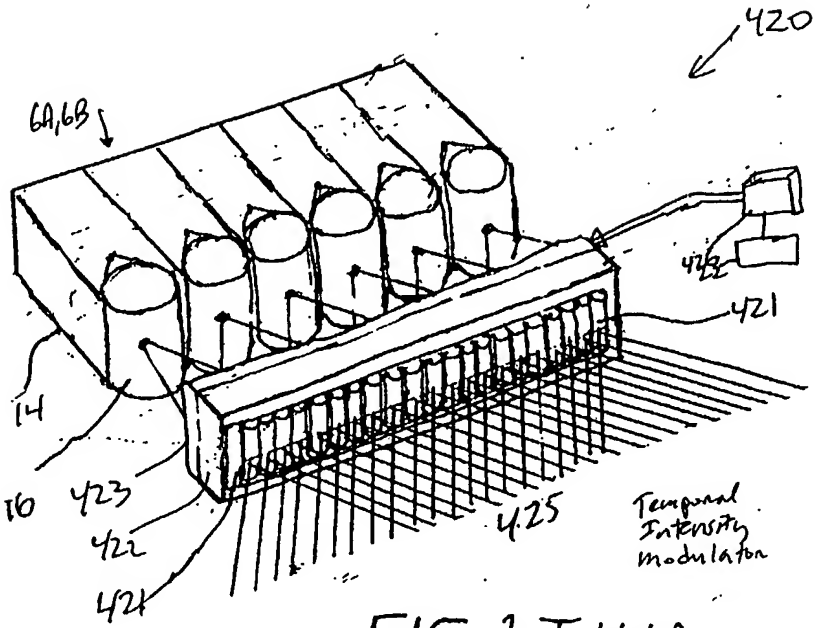

FIG. 1I14A

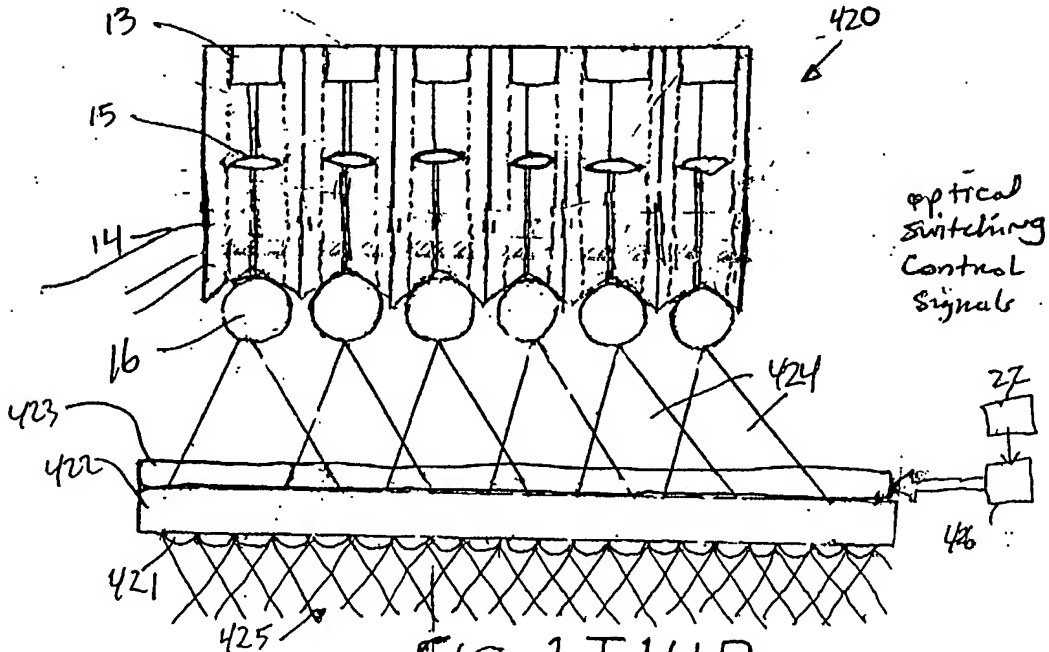

FIG. 1I14B

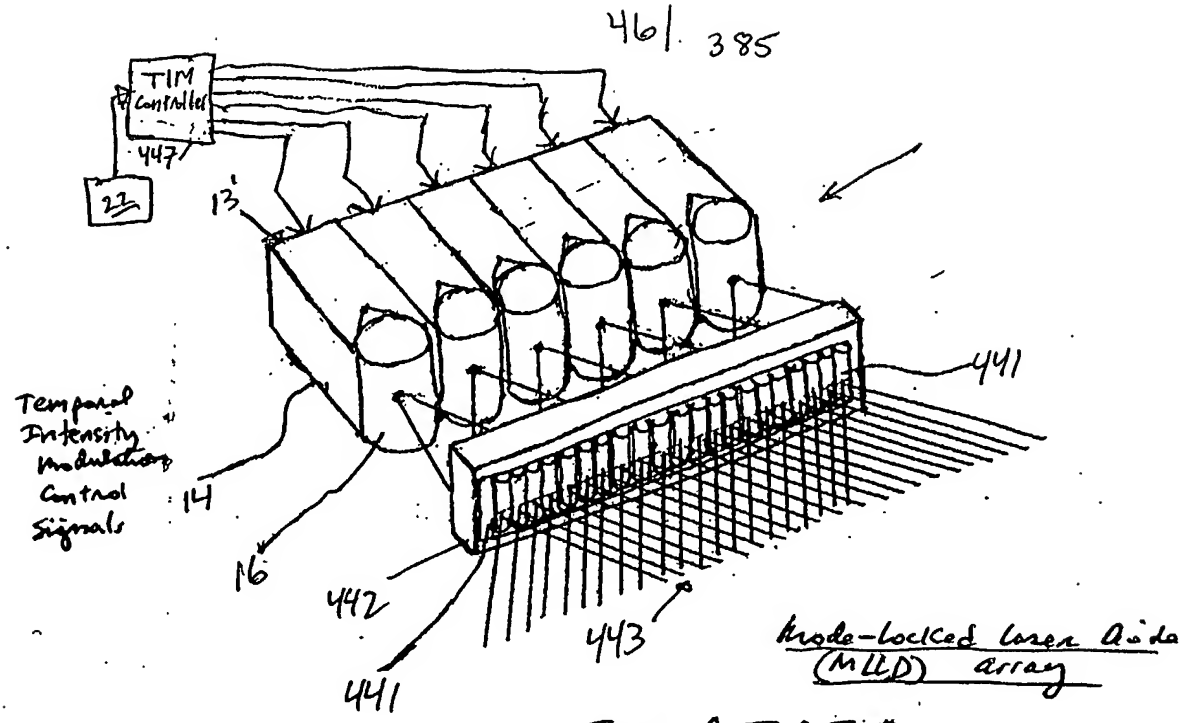

FIG. 1I15A

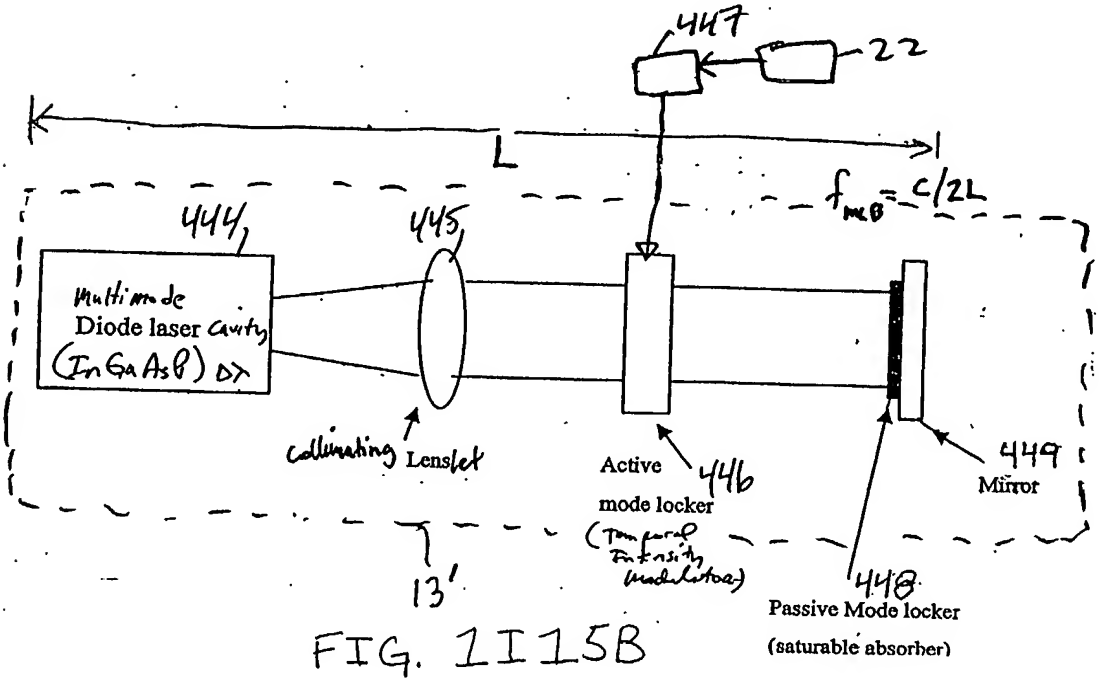

FIG. 1I15B

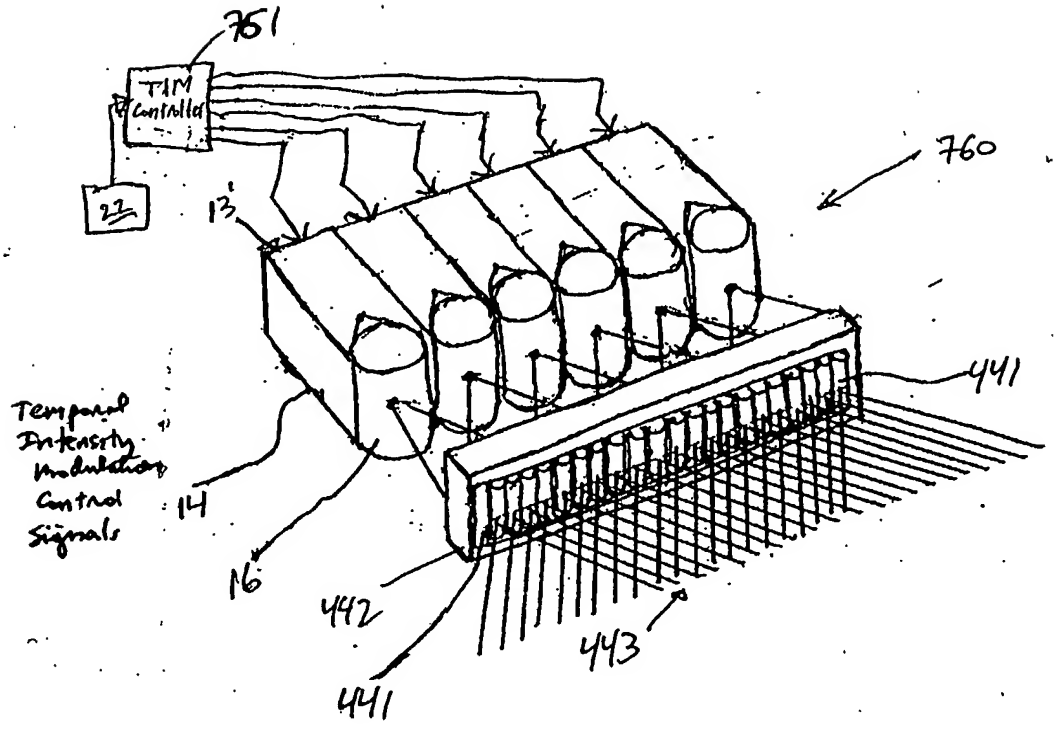

FIG. 1I 15C

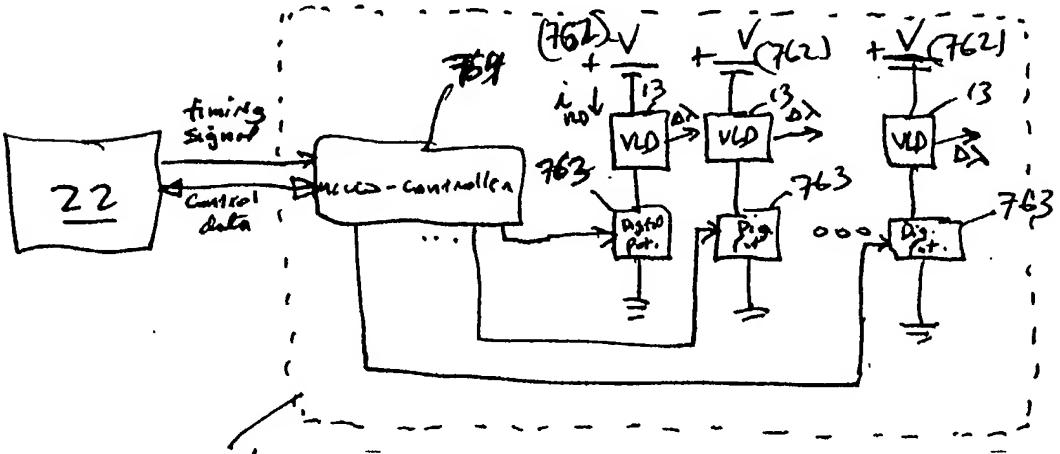

FIG. 1I 15D

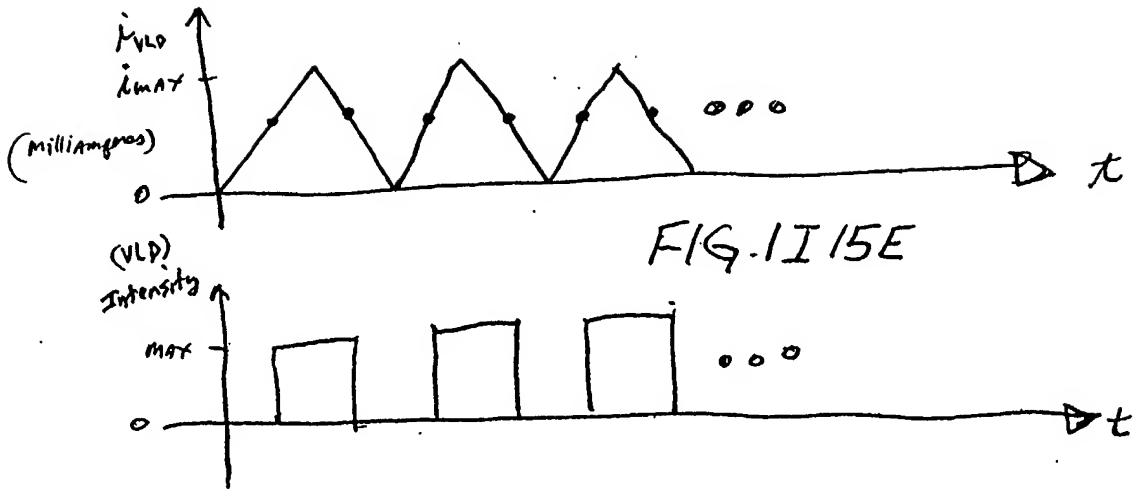

FIG. 1I15E

FIG. 1I15E

Third Generalized Method of Reducing Speckle-Noise Patterns at Image Detection Array of the IFD Subsystem (3)

(TIMF)

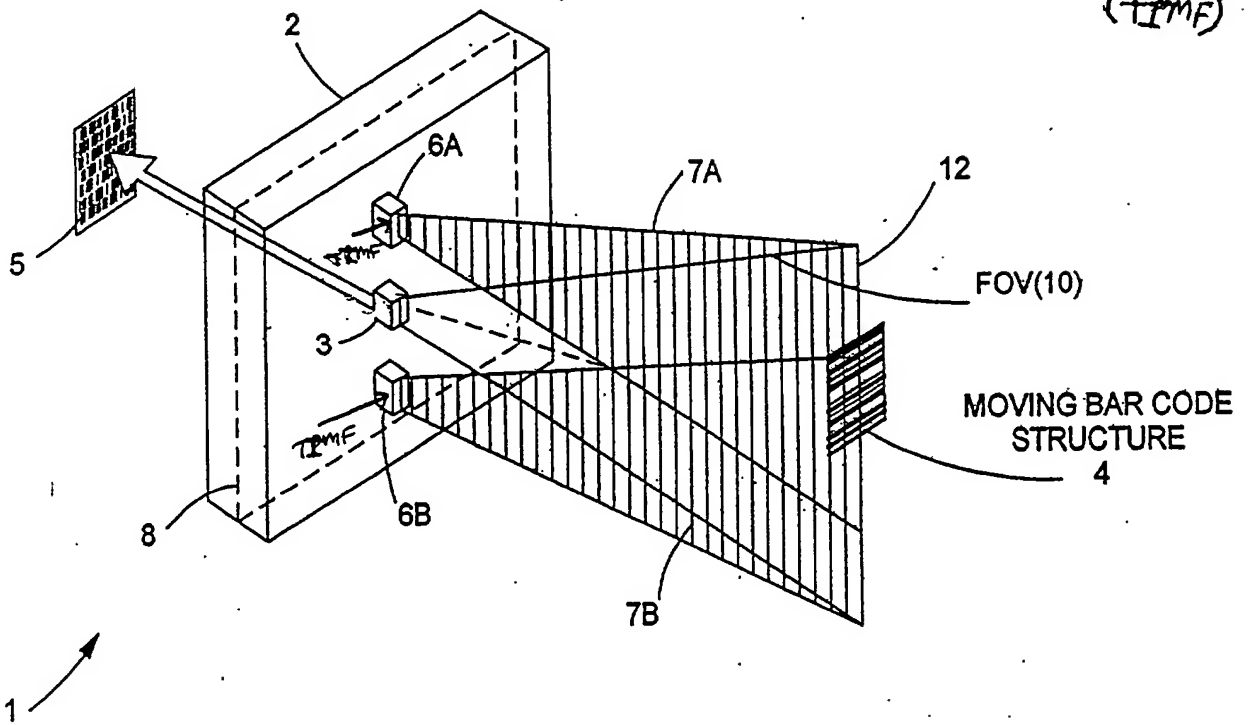

FIG. 11 16

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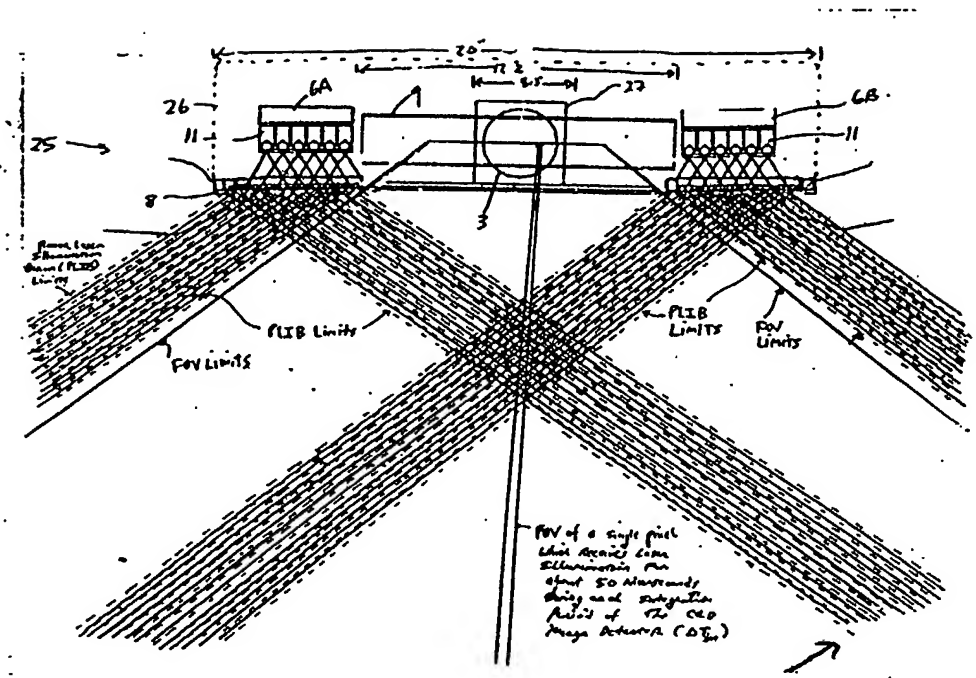

TPMF

FIG. 1I16A

Third Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal phase of the transmitted PLIB ~~along the planar extent thereof~~ according to a temporal phase modulation function (TPMF) so as to:

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof. — A

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array. — B

FIG. 1I/6B

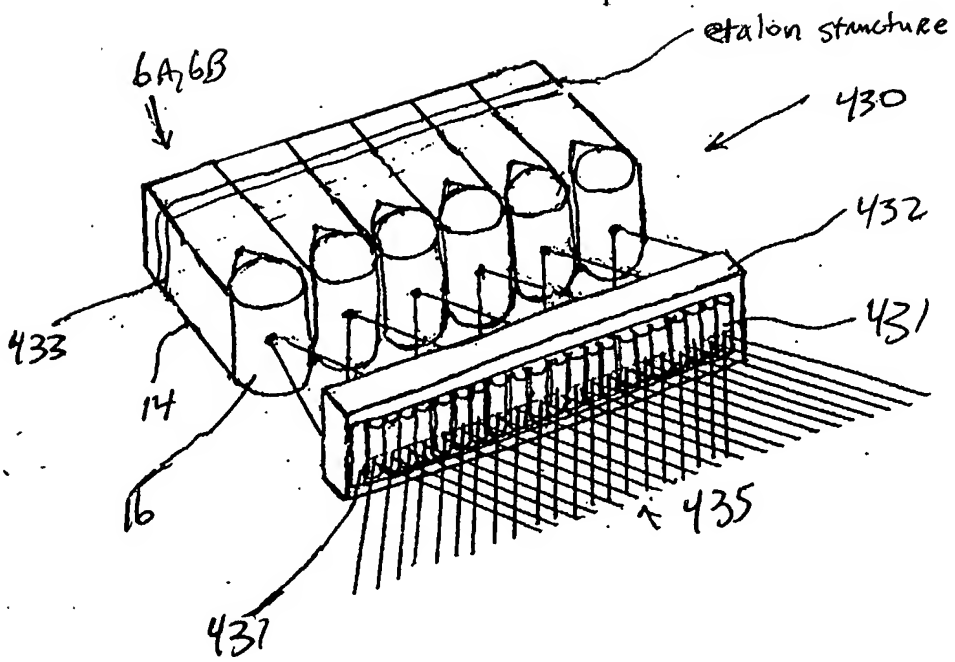

FIG. 1I 17A

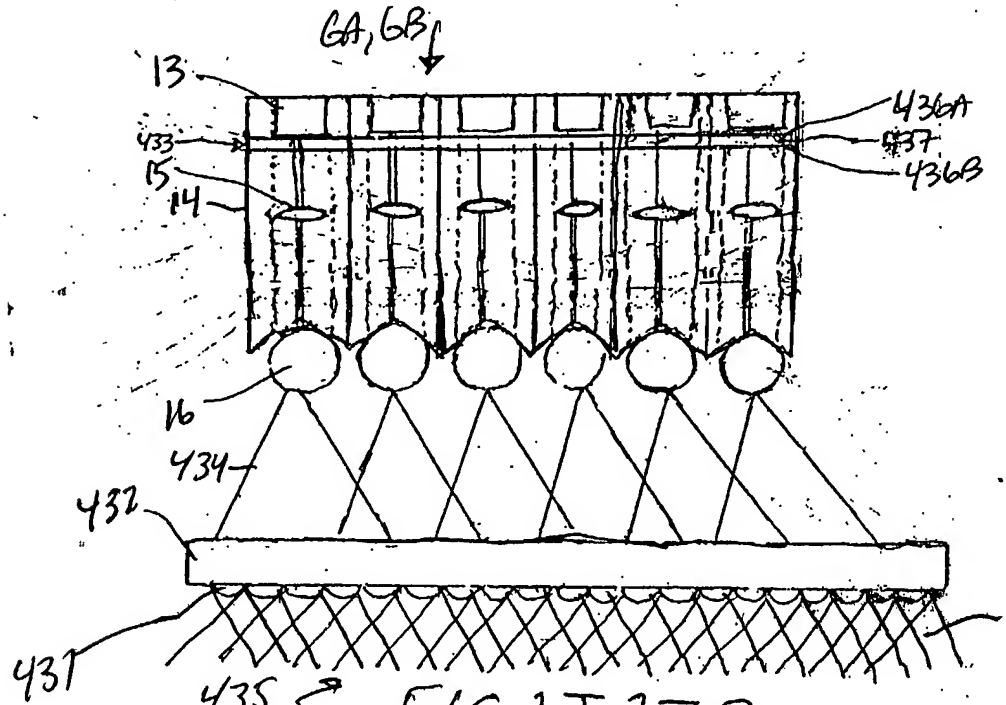

FIG. 1I 17B

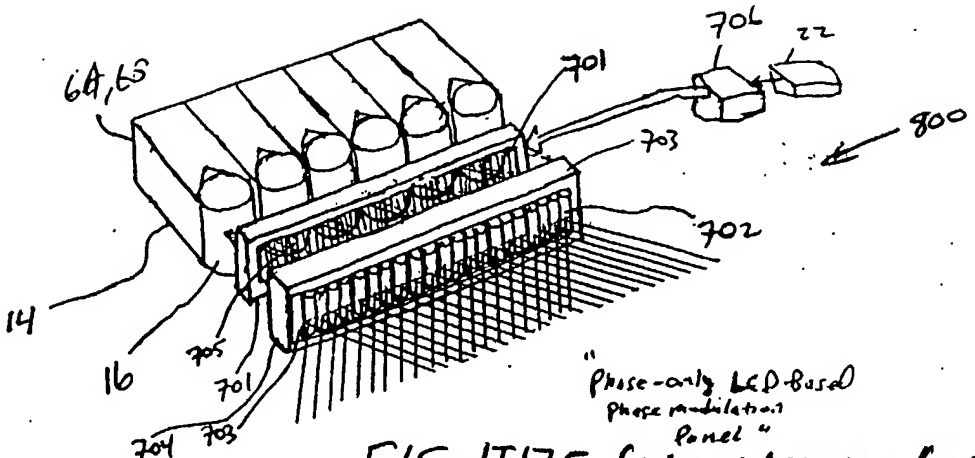

FIG. 1I17C ($\Delta\phi$ > coherence length of VLD

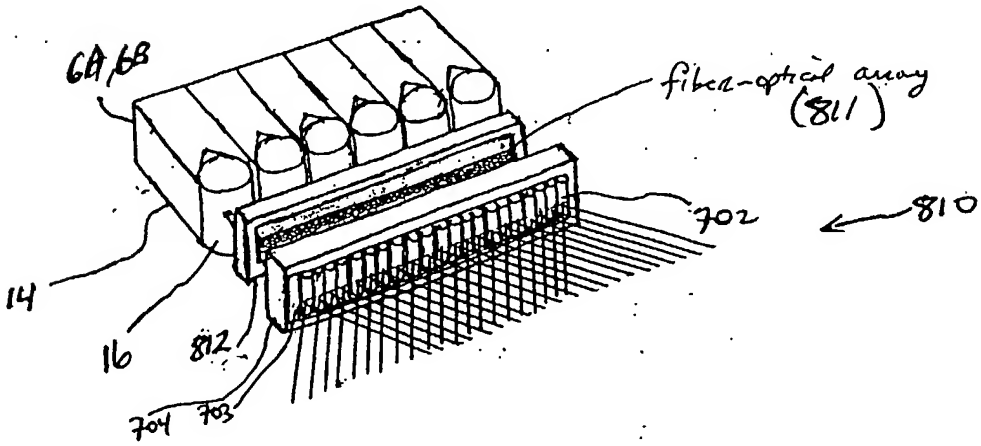

FIG. 1I17D

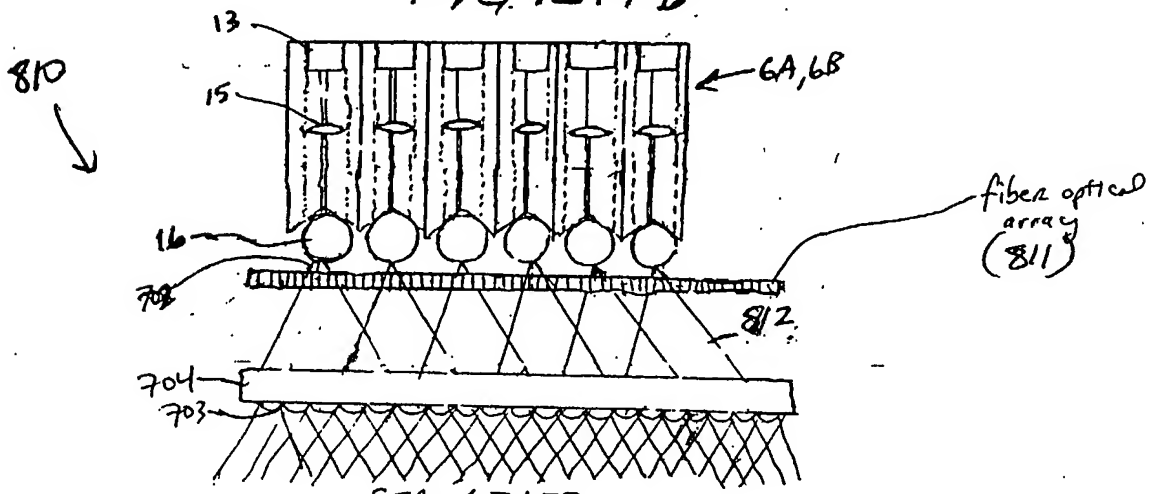

FIG. 1I17E

Fourth Generalized Method of Reducing Speckle-Noise Patterns at Image Detection Array of the IFD Subsystem (3)

(TFMP)

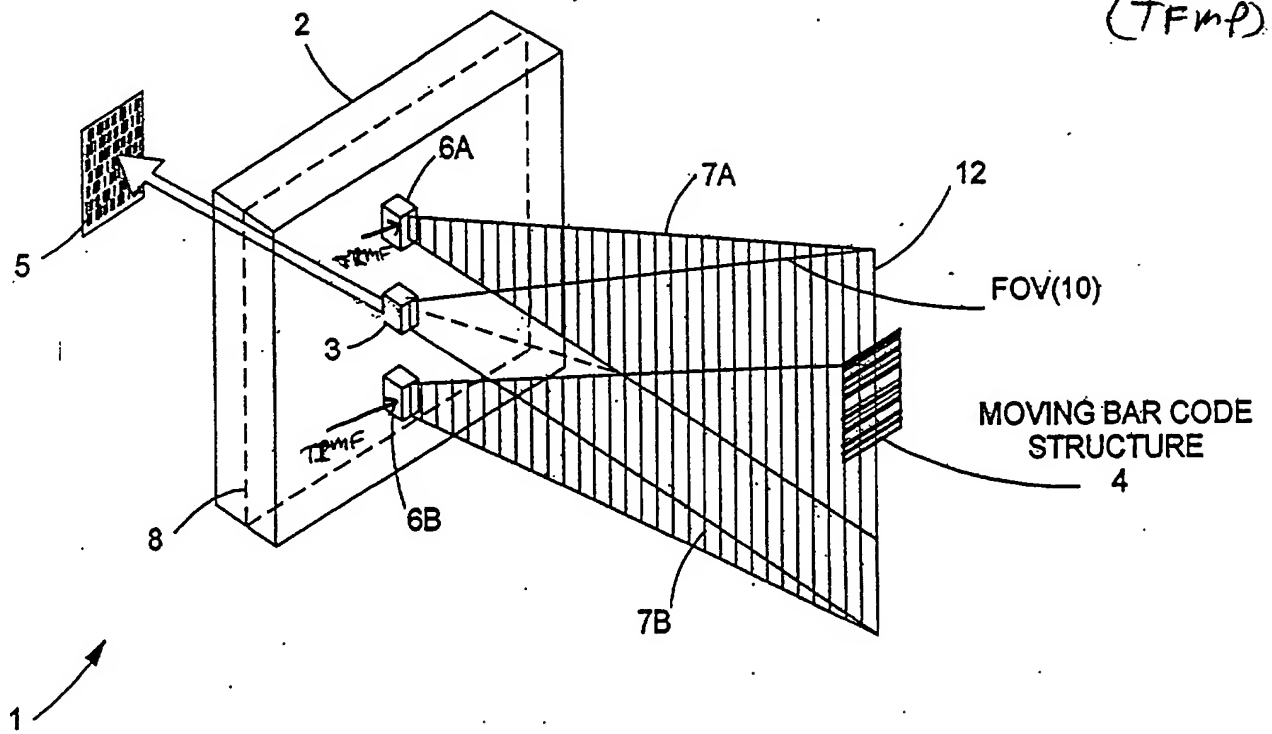

FIG. 11B

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US 6,244,502 B1

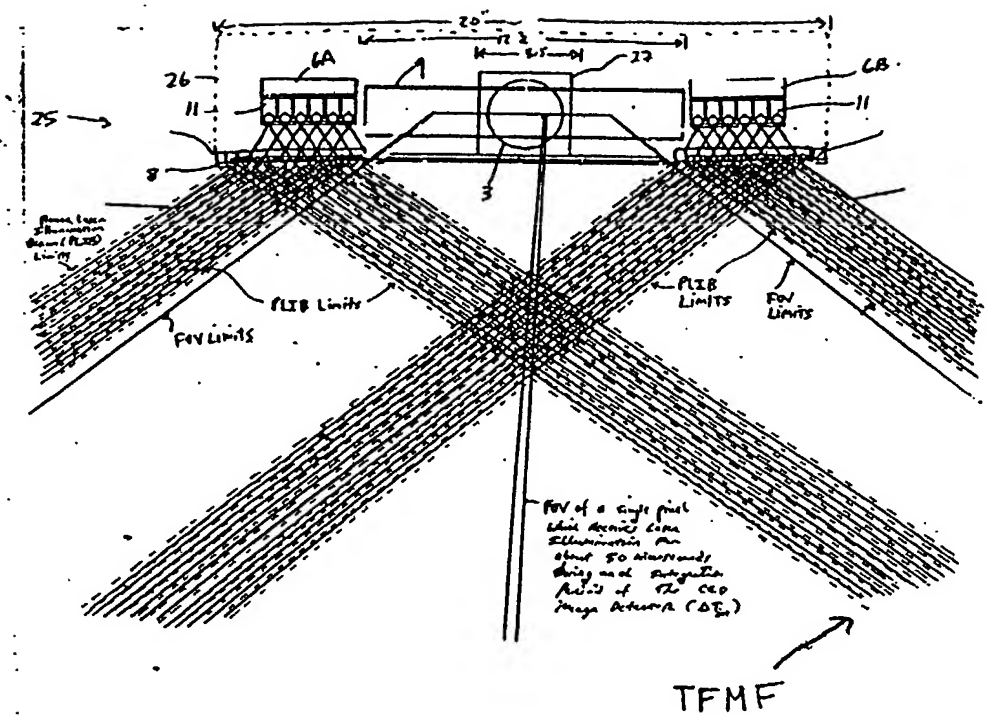
20"
6A
6B
22
26
11
25
8
3
FLIB Limits
FOV Limits
FLIB Limits
FOV Limits
TFMF

FIG. 1I 18A

Fourth Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal frequency of the transmitted PLIB according to a temporal intensity modulation function (TIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof. — A

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array. — B

FIG 1I18B

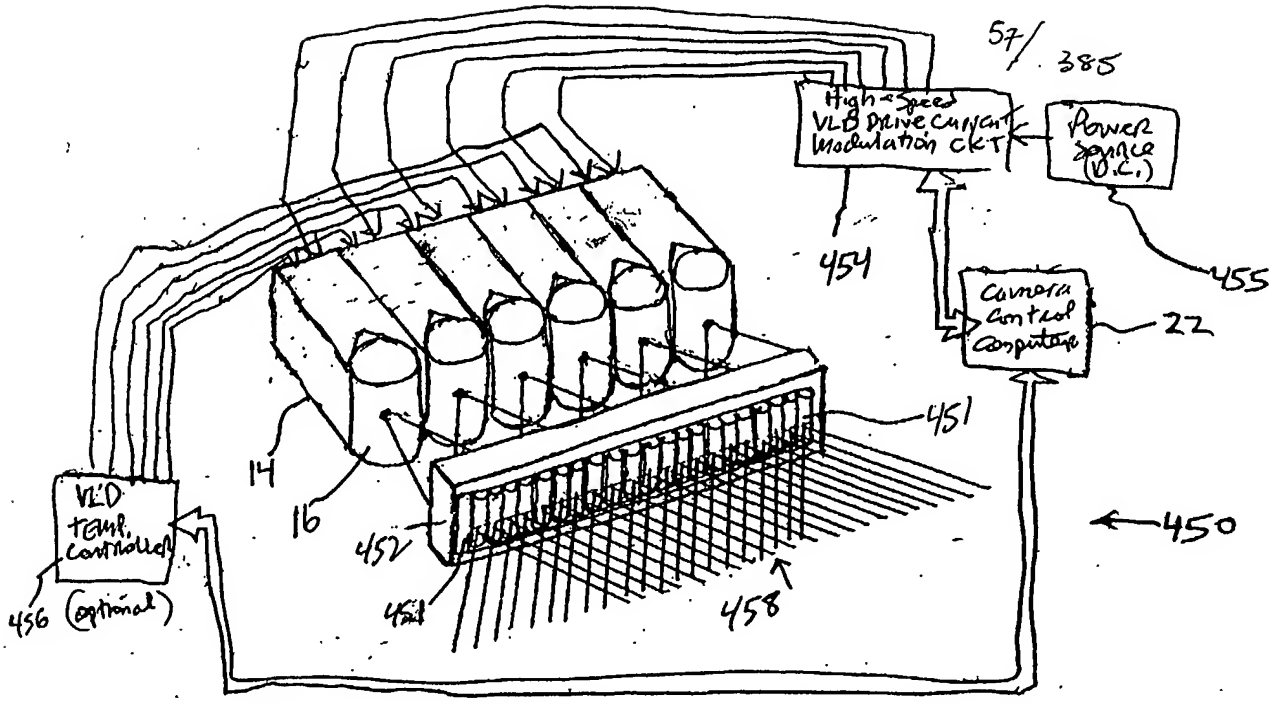

FIG. 1I19A

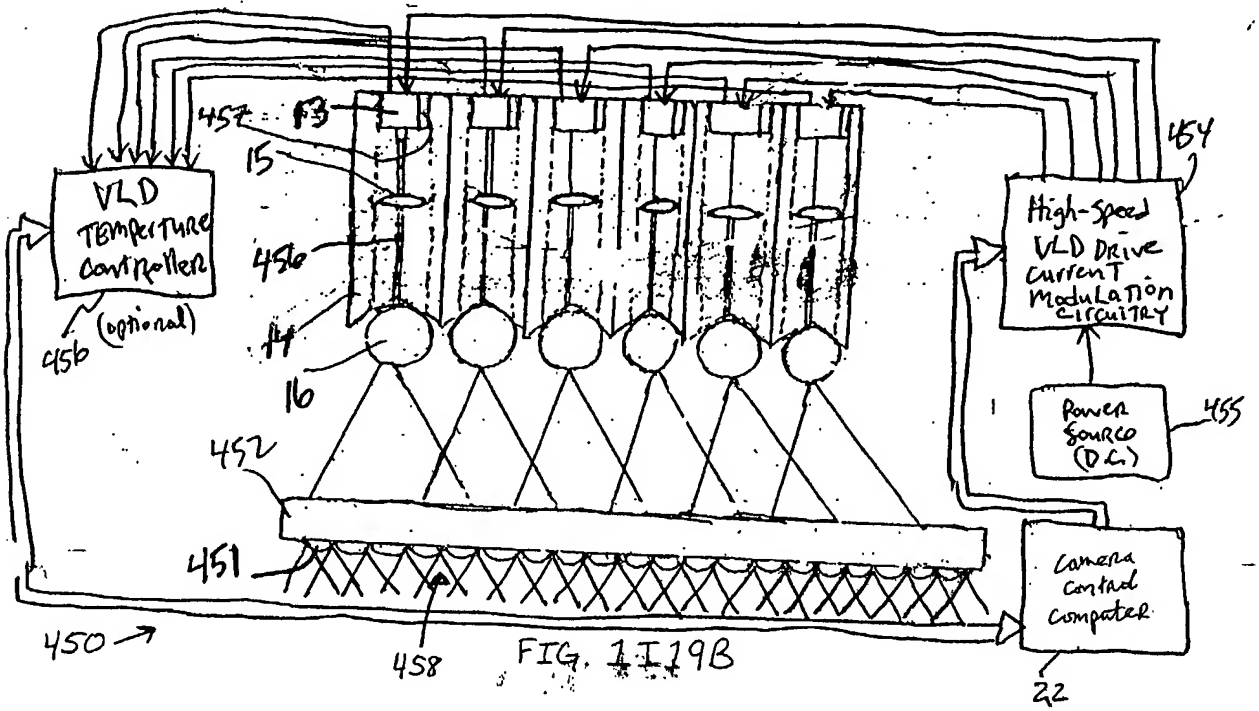

FIG. 1I19B

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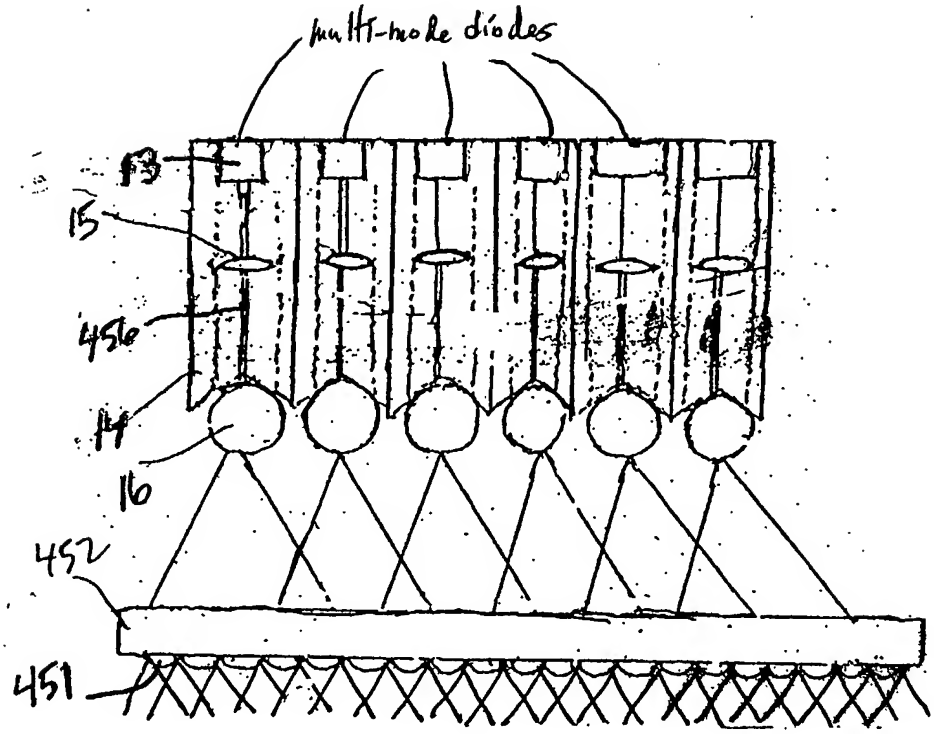


FIG 11C

~~Fifth~~ GENERALIZED METHOD of Reducing Speckle-Noise PATTERNS AT IMAGE Detection array of the IFD SubSystem (3)

(S'MF)

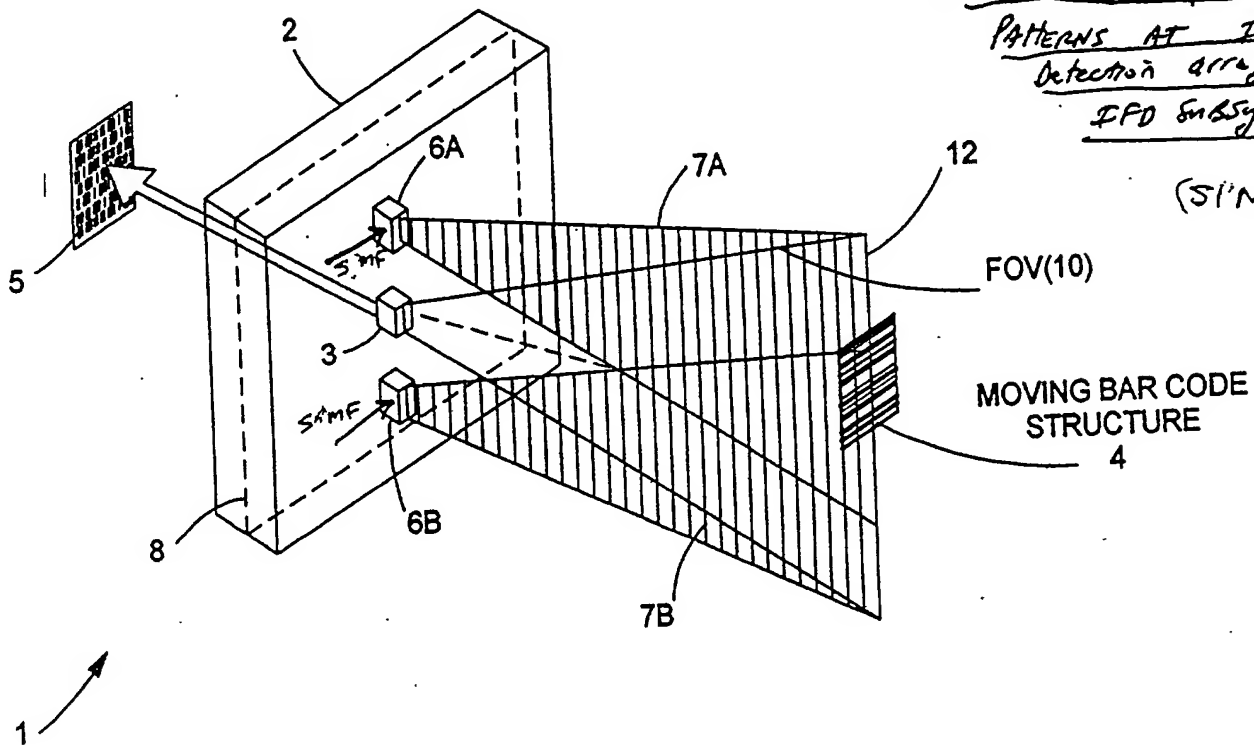
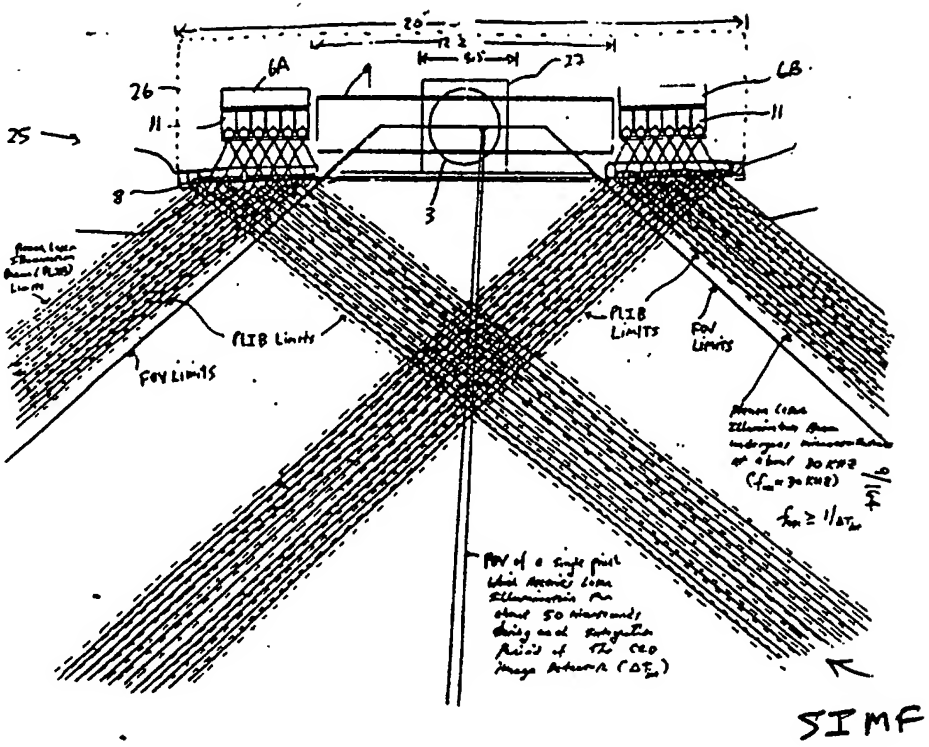


FIGURE 20

591 385



Prior to object Illumination

FIG. 1I 20A

20-2220-0" 2222+0000

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Fifth Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the transmitted PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to .

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

A

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array.

B

FIG. 1I20B

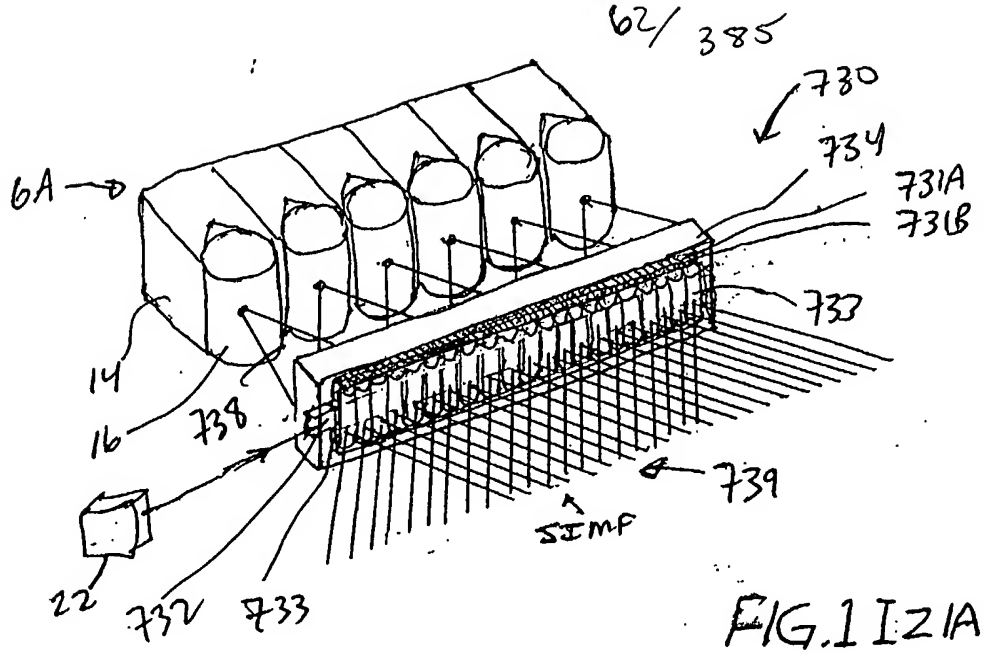

FIG. 1I21A

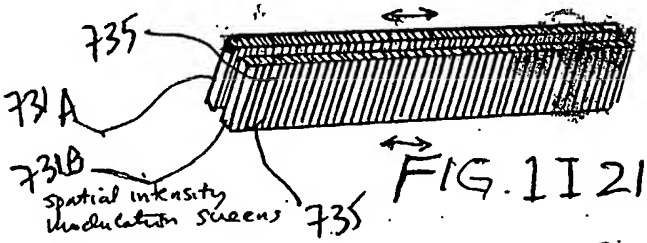

FIG. 1I21B

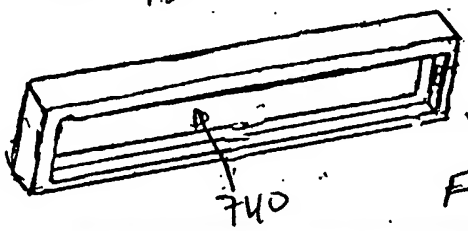

FIG. 1I21C

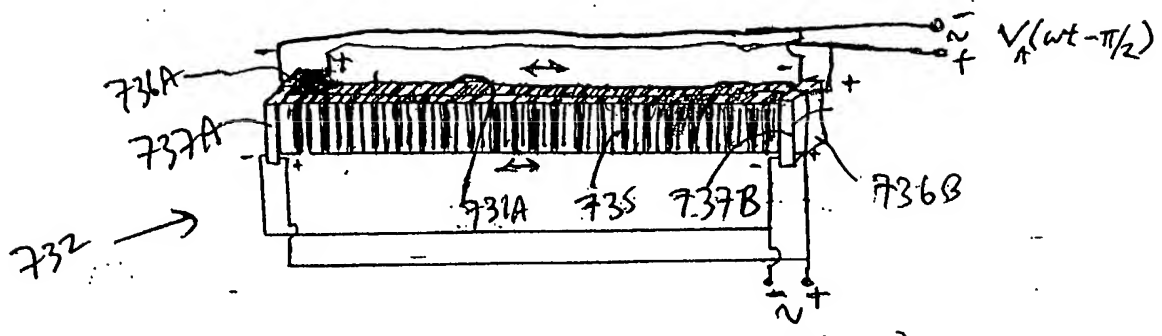

FIG. 1I21D

Generalized Method of
Reducing Speckle-Noise Patterns
at Image Detection Array
of the IFD Subsystem

(SIMF)

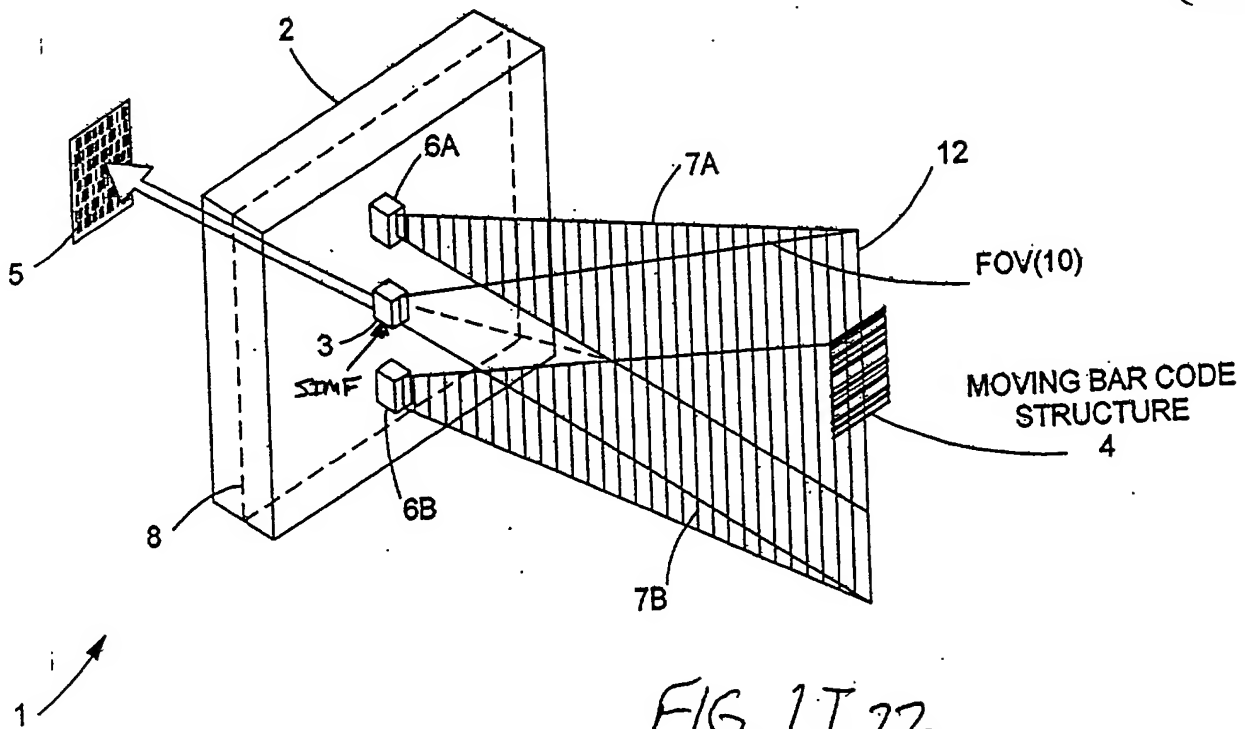

FIG. 11 22

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Docket #RD-29,878

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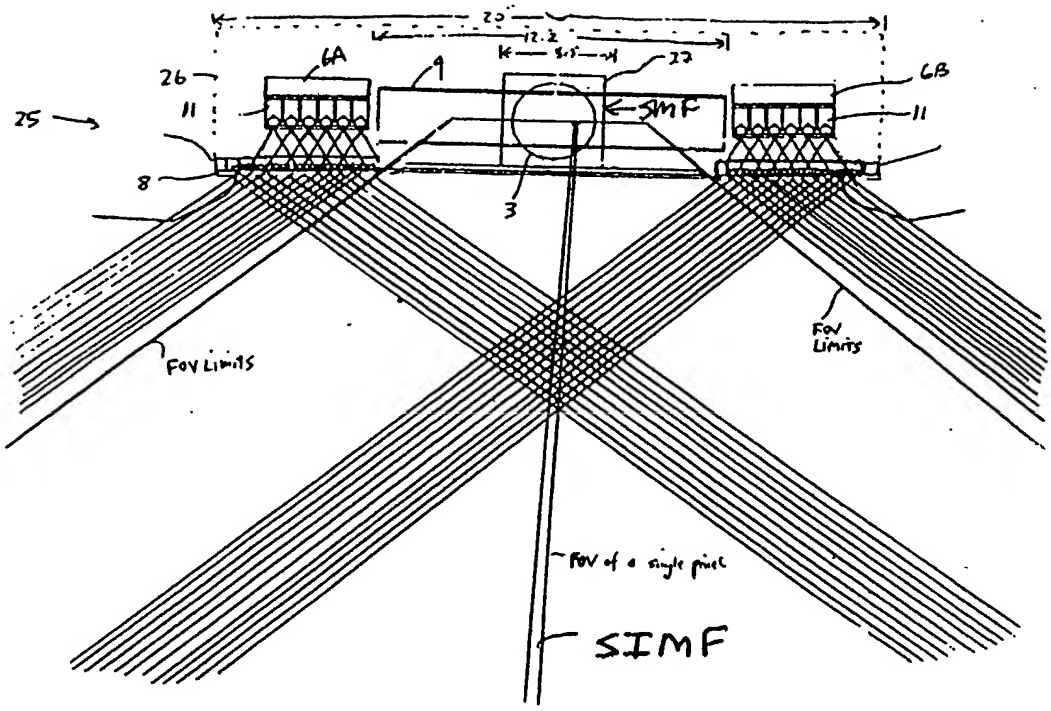

FIG. II 22A

Sixth Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

After illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to :

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof. — A

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array. — B

FIG. 11 22B

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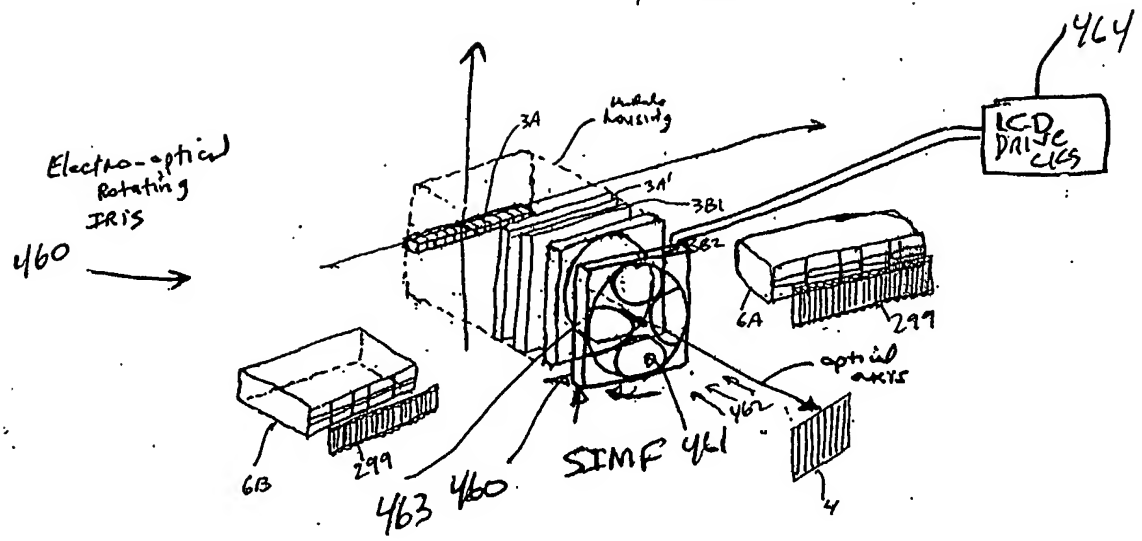

FIG. 1I 23A

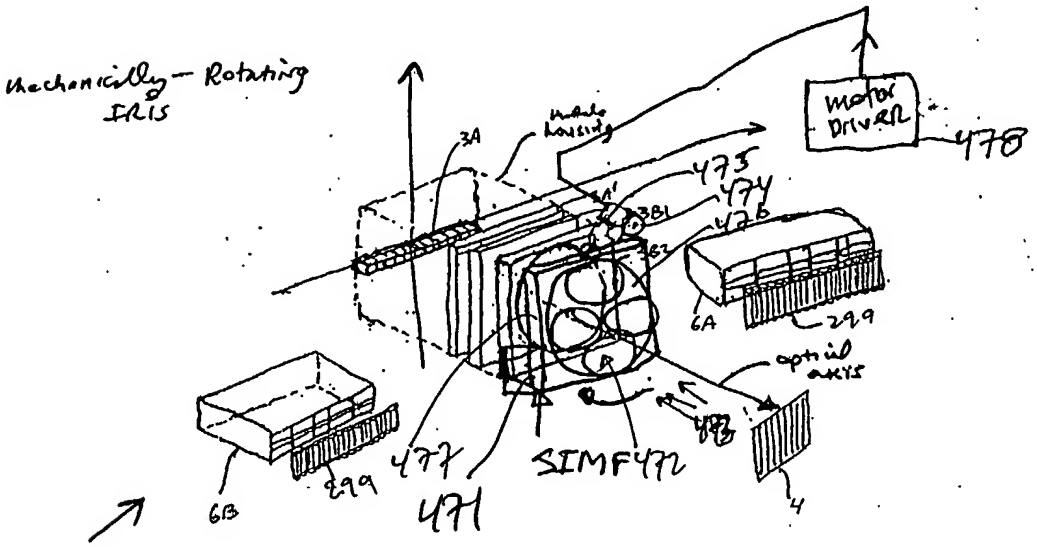

FIG. 1I 23B

Seventh Generalized Method of Reducing Speckle-Noise Patterns at Image Detection Array of the IFD Subsystem

(TIMF)

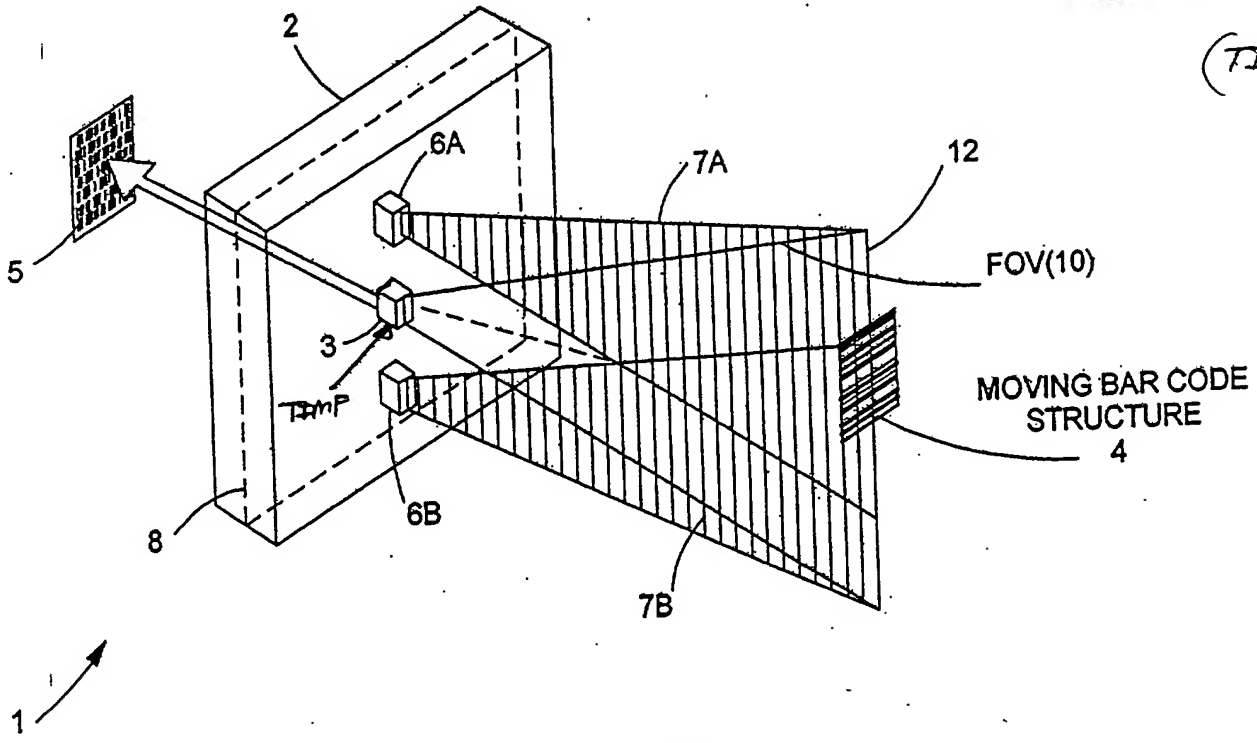

FIG. 1I 24

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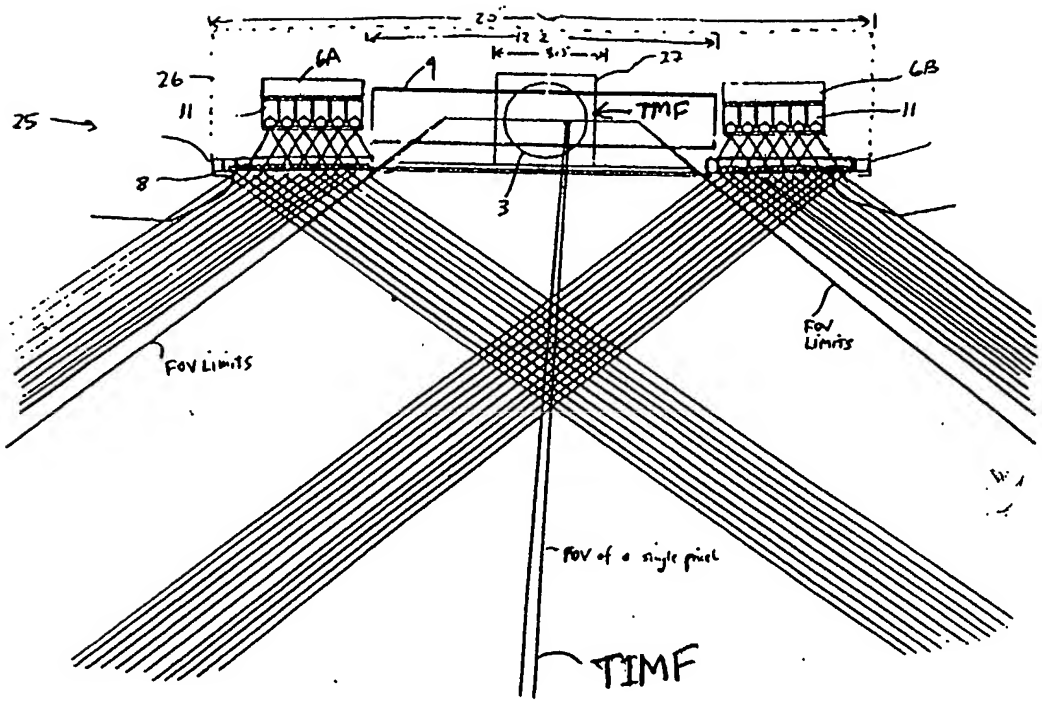

FIG. 1I24A

Seventh Generalized Speckle-Noise Pattern Reduction Method Of The Present Invention

After illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to . produce many substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof. — A

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array. — B

FIG. 11 24B

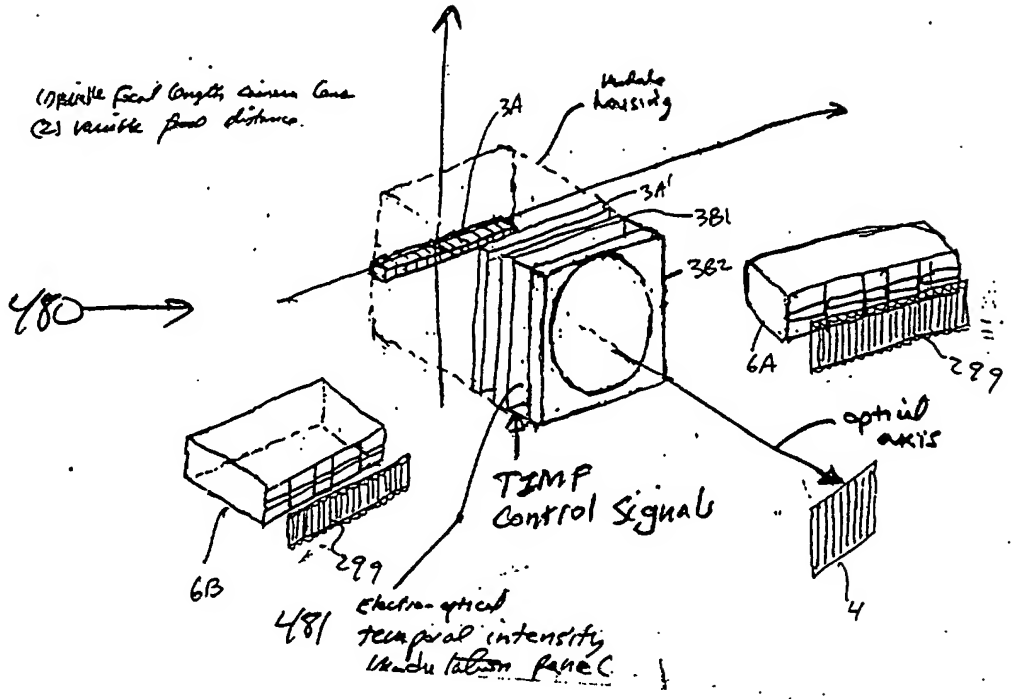
(1) variable focal length zoom lens
(2) variable focal distance
3A
variable housing
3A'
3B1
3B2
480
6A
299
optical axis
TIMP Control Signals
6B
299
481
electro-optical temporal intensity modulation panel
4

FIG. 1I Z4C

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EIGHT GENERALIZED METHOD OF REDUCING THE SPECKLE PATTERN NOISE OBSERVED IN PLIIM-BASED IMAGING SYSTEMS

A: Use a PLIIM-BASED Imager to produce a series of consecutively captured digital images of an object over a series of photo-integration time periods of the PLIIM-Based Imager, wherein each digital image of the object includes a substantially different speckle noise pattern produced by natural oscillatory micro-motion and/or forced oscillatory micro-movementof the Imager relative to the object during operation of the PLIIM-Based Imager.

B: Store the series of consecutively captured digital images of the object in buffer memory within the PLIIM-Based Imager.

C: Add relatively small (e.g. 3x3) windowed image processing filters to the additively combine and average the pixel data in the series of consecutively captured digital images so as to produce a reconstructed digital image having a speckle noise pattern with reduced RMS power.

FIG. 1I24D

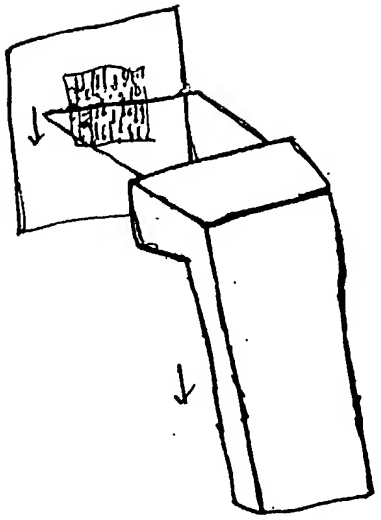


FIG. 1I24E

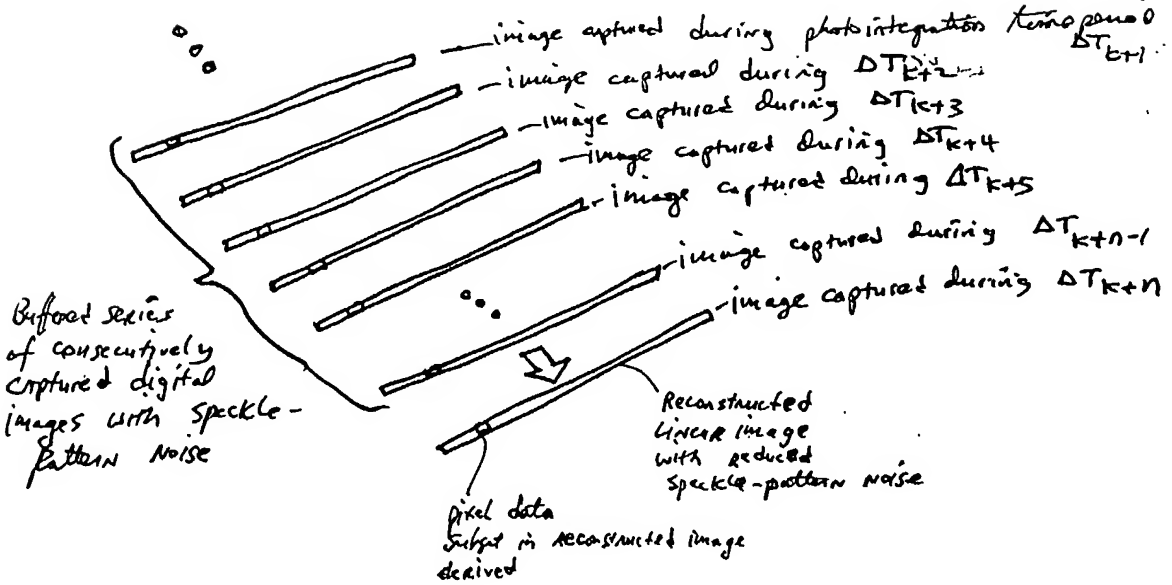


FIG. 1I24F

Case: Linear Imager

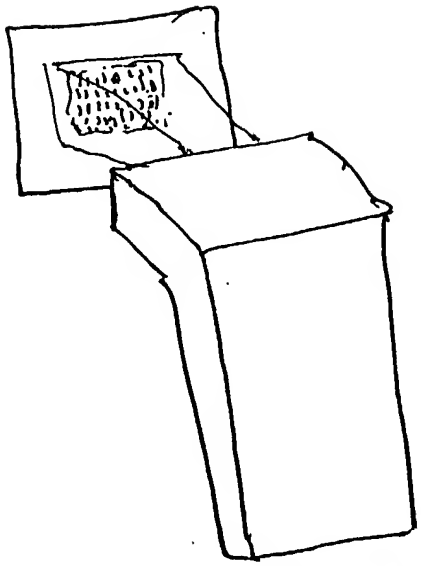


FIG. 1I24G

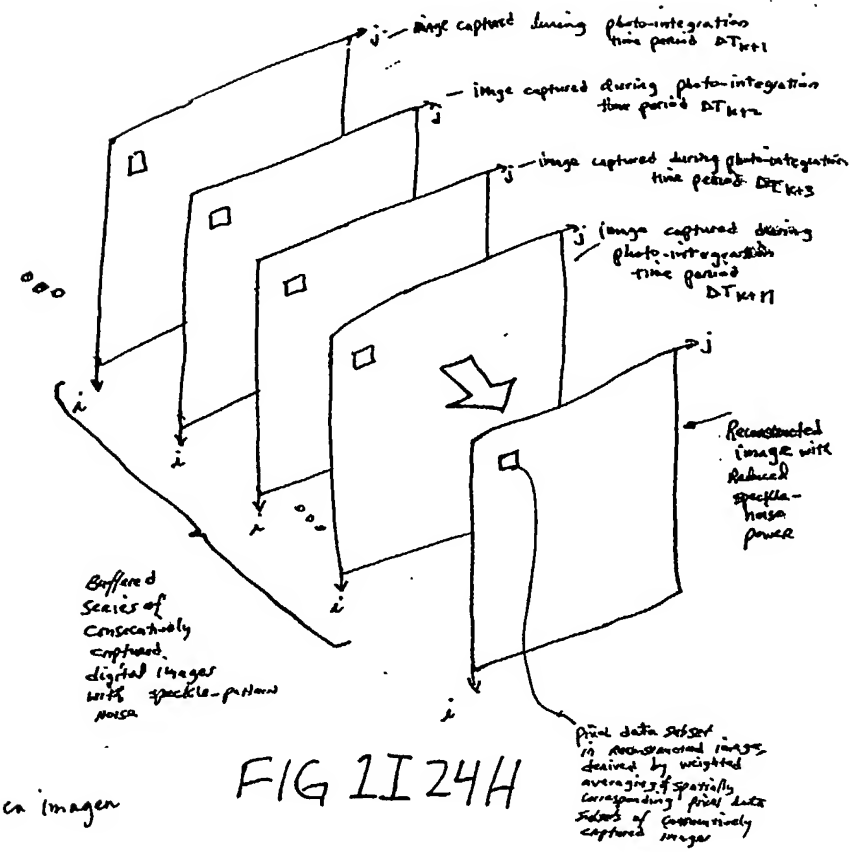


FIG 1I24H

Case: 2D Area Imagers

NINTH GENERALIZED METHOD OF REDUCING SPECKLE PATTERN NOISE IN PLIIM-BASED IMAGING SYSTEMS

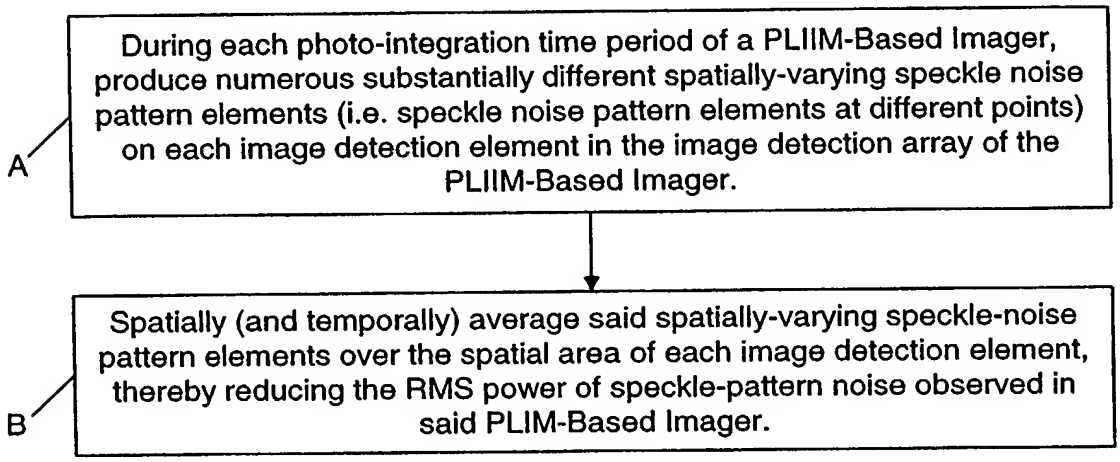
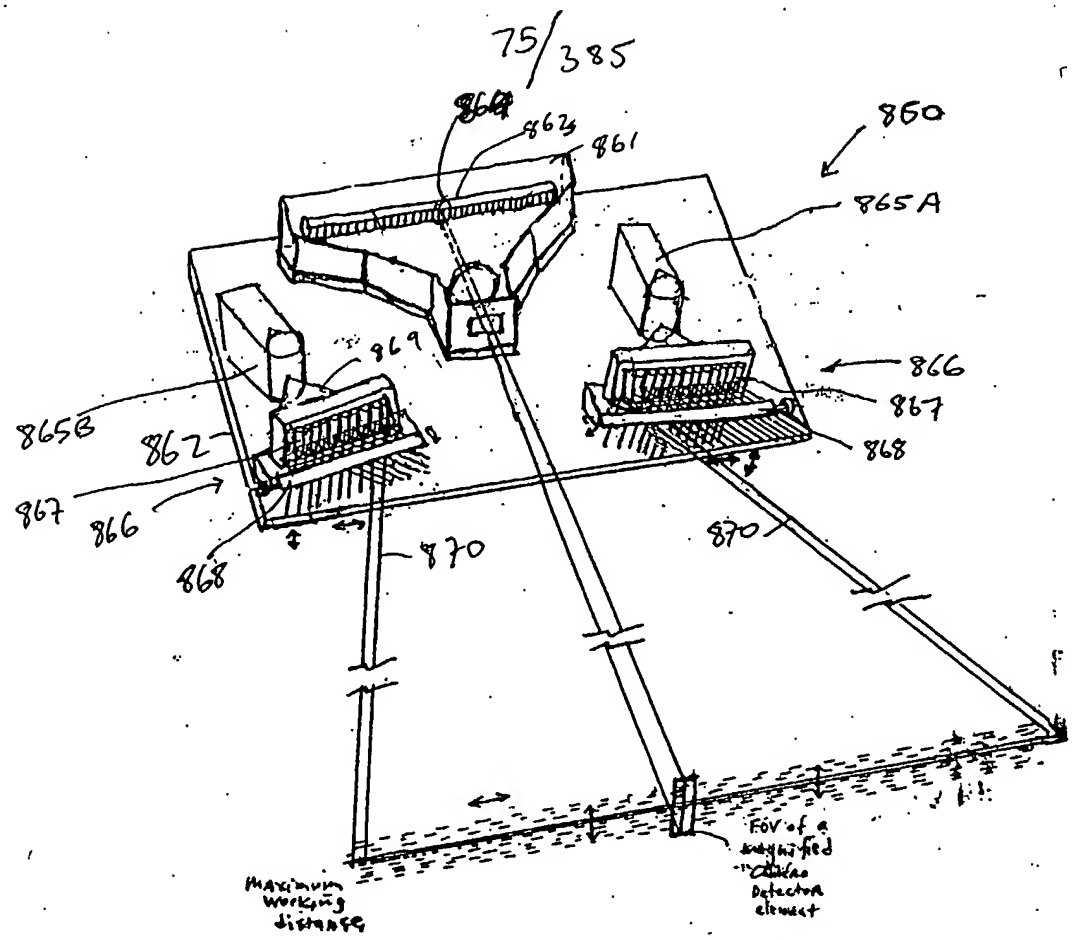


FIG. 11241



* Lateral and Transverse Microoscillation of PLIB

FIG. 1I25A1

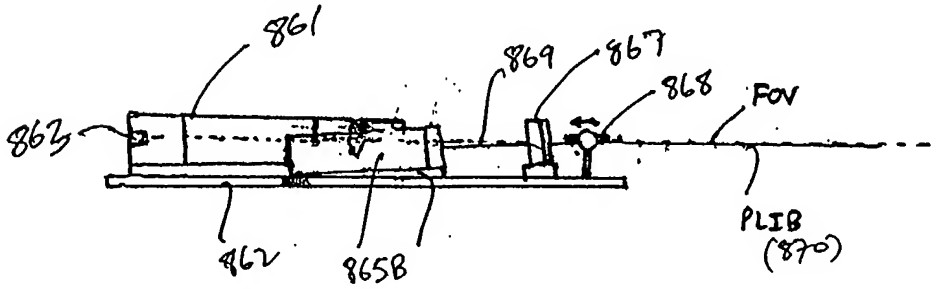


FIG. 1I25A2

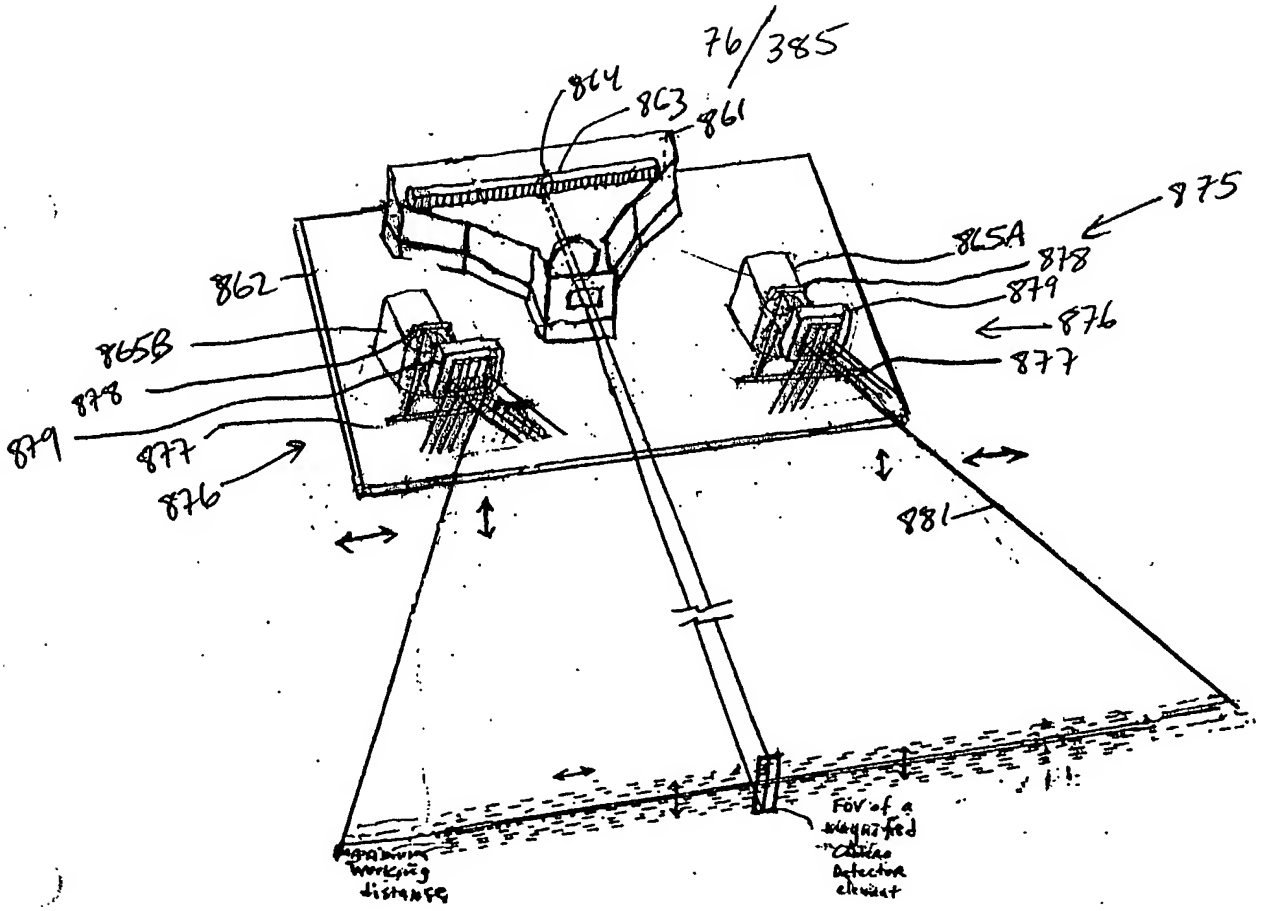


FIG. 1I25B1

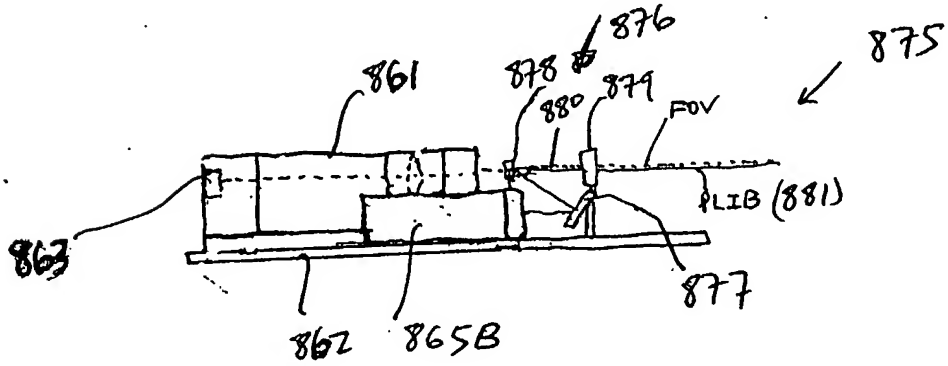


FIG. 1I25B2

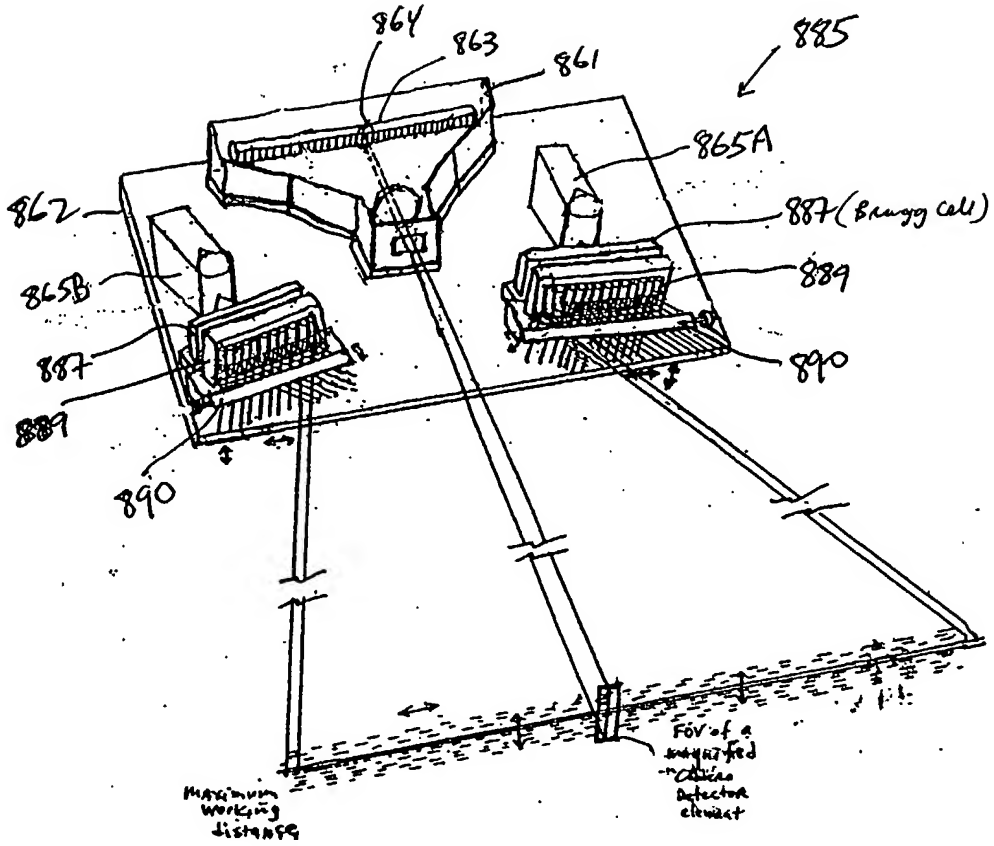


FIG. 1I25C1

* Lateral and Transverse Microoscillation of PLIB

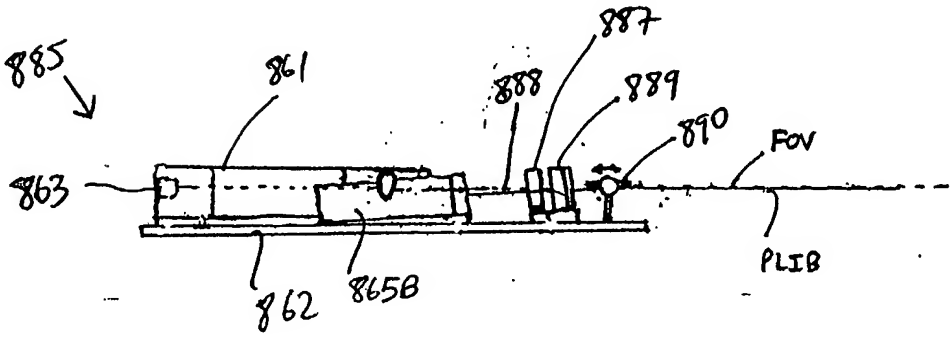


FIG. 1I25C2

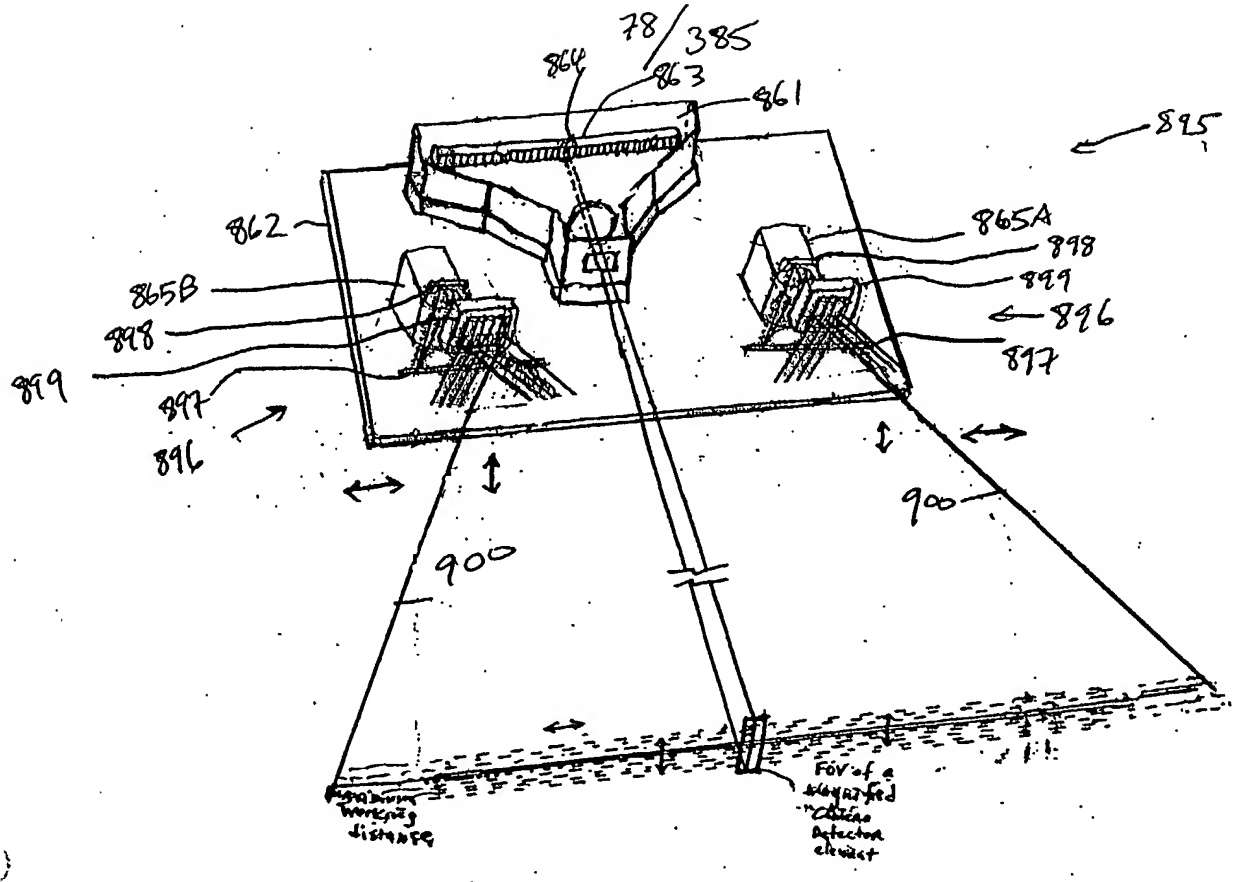


FIG. 1I25D1

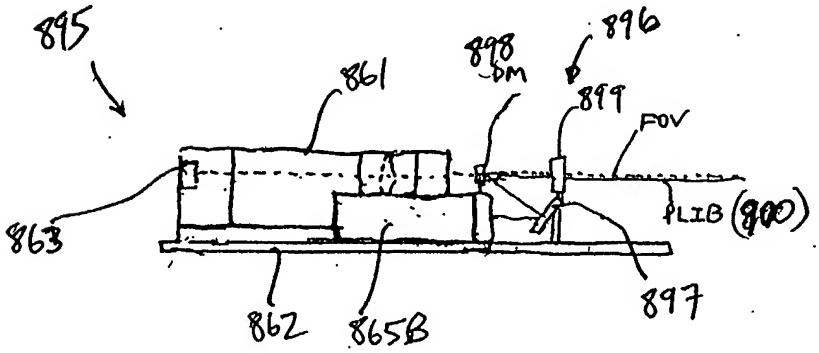


FIG. 1I25D2

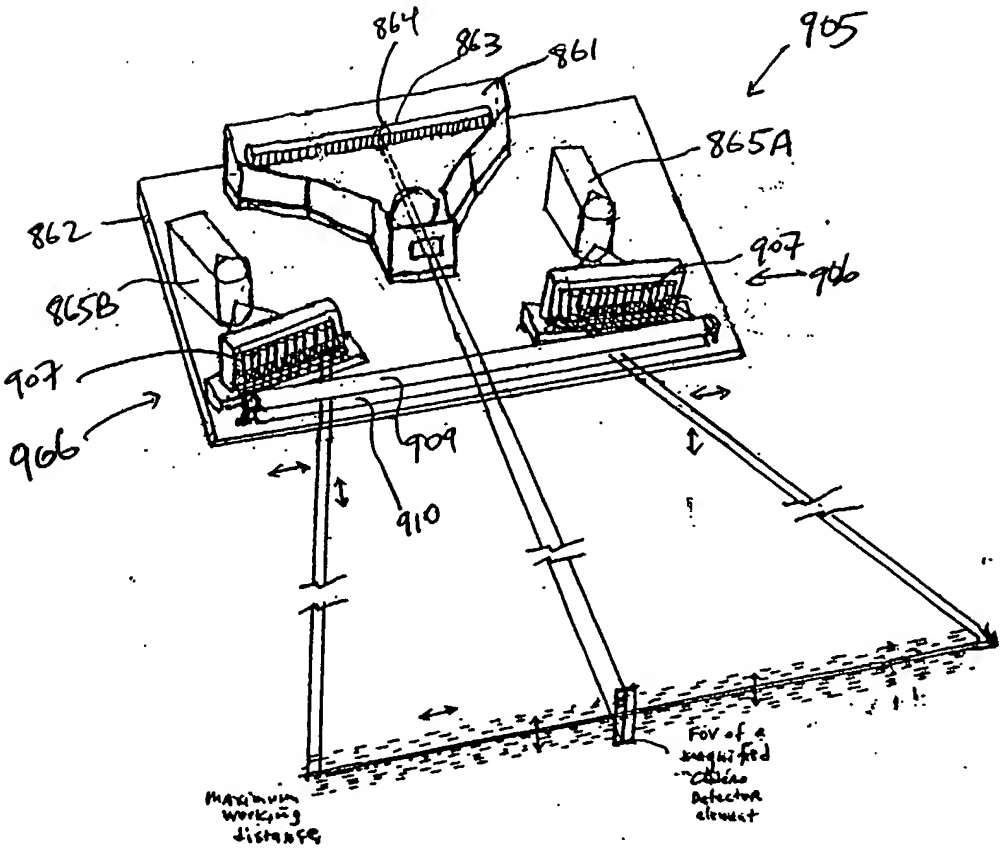


FIG. 1I25E1

* Lateral and Transverse Microoscillation of PLIB

905

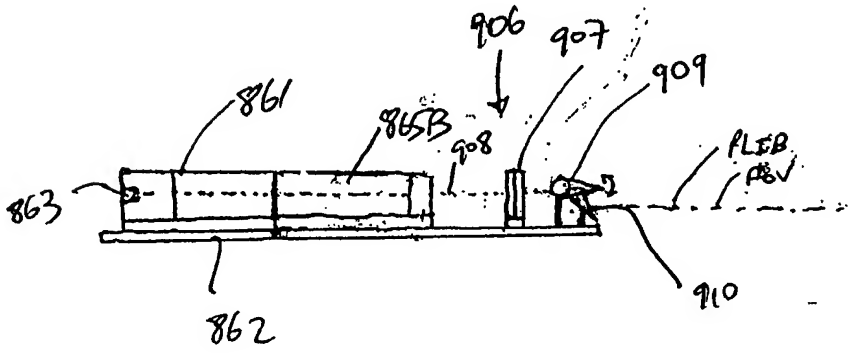


FIG. 1I25E2

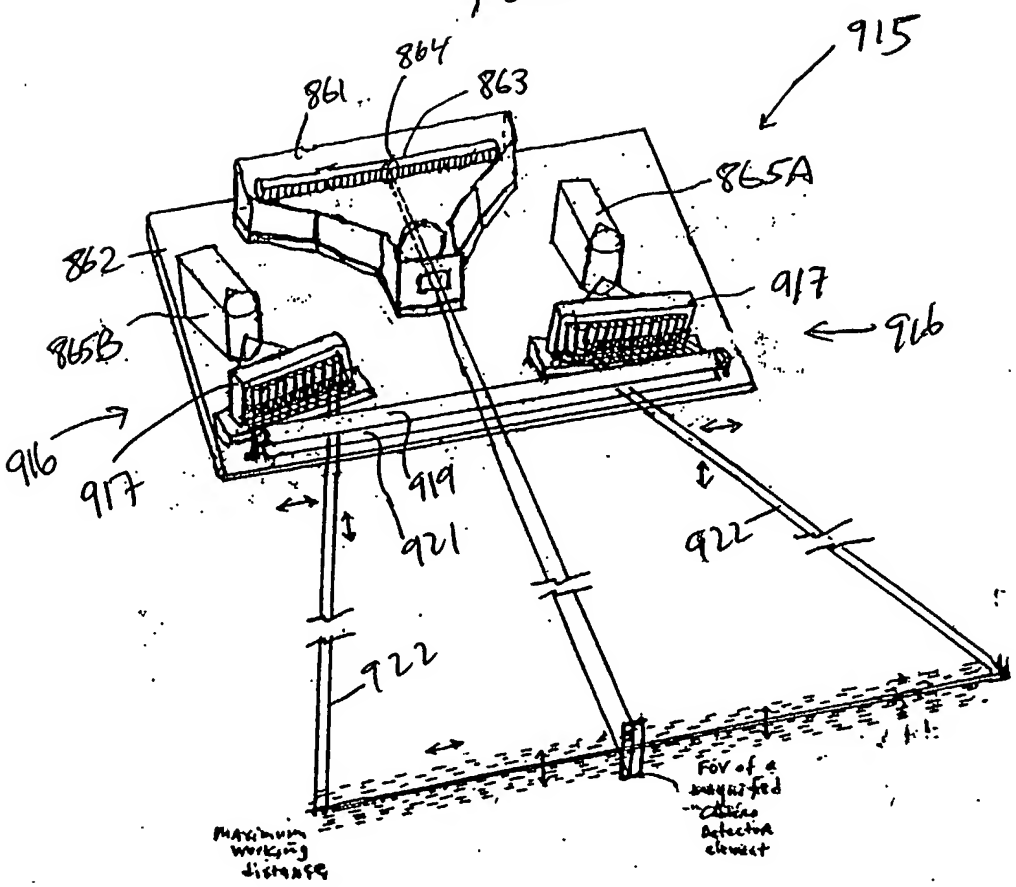


FIG. 1I25P1

* Lateral and Transverse Microoscillation of PLIB

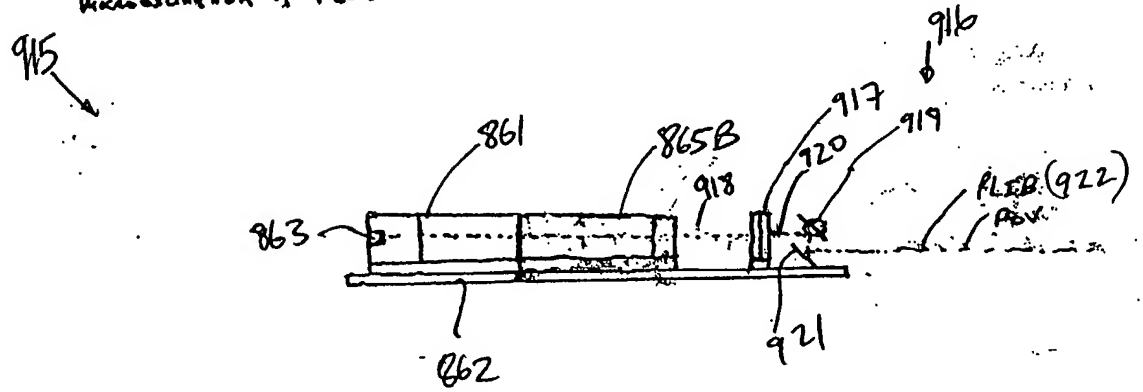


FIG. 1I25F2

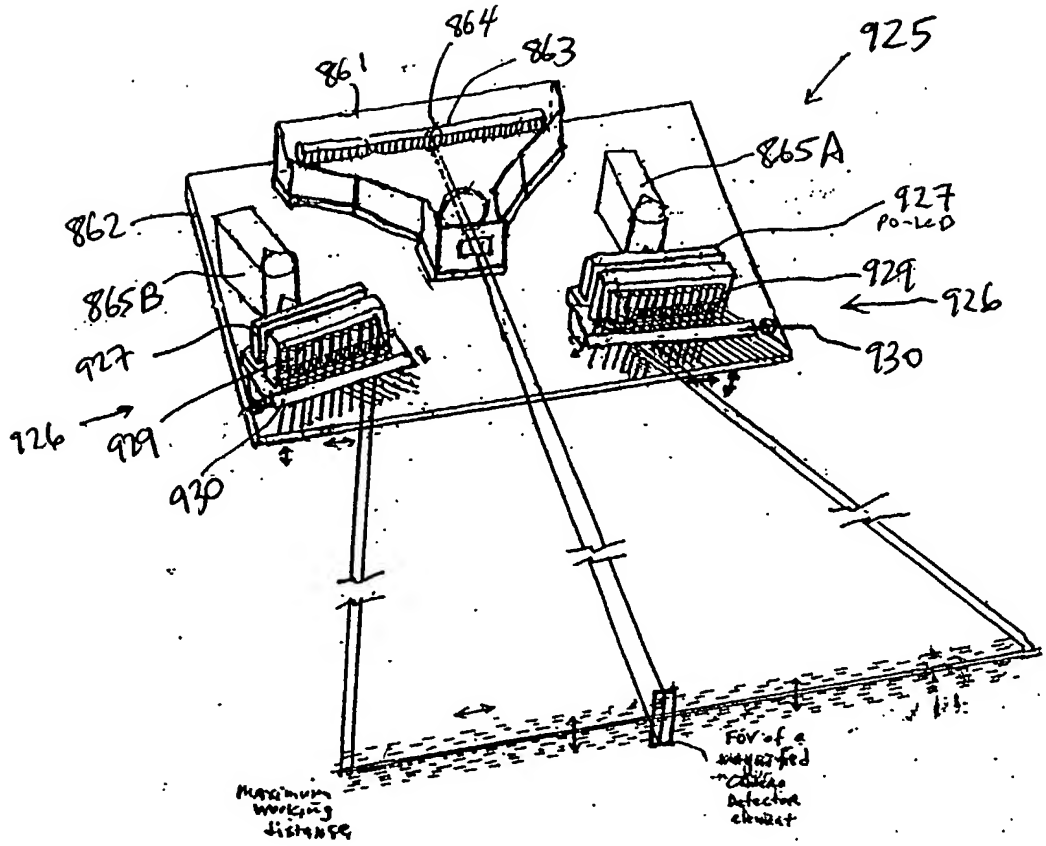


FIG. 1I25G1

* Lateral and Transverse Micro-oscillation of PLIB

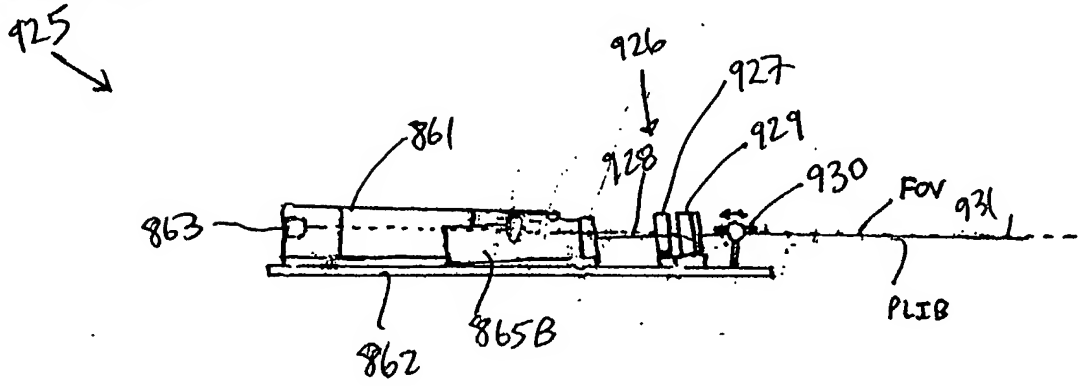


FIG. 1I25G2

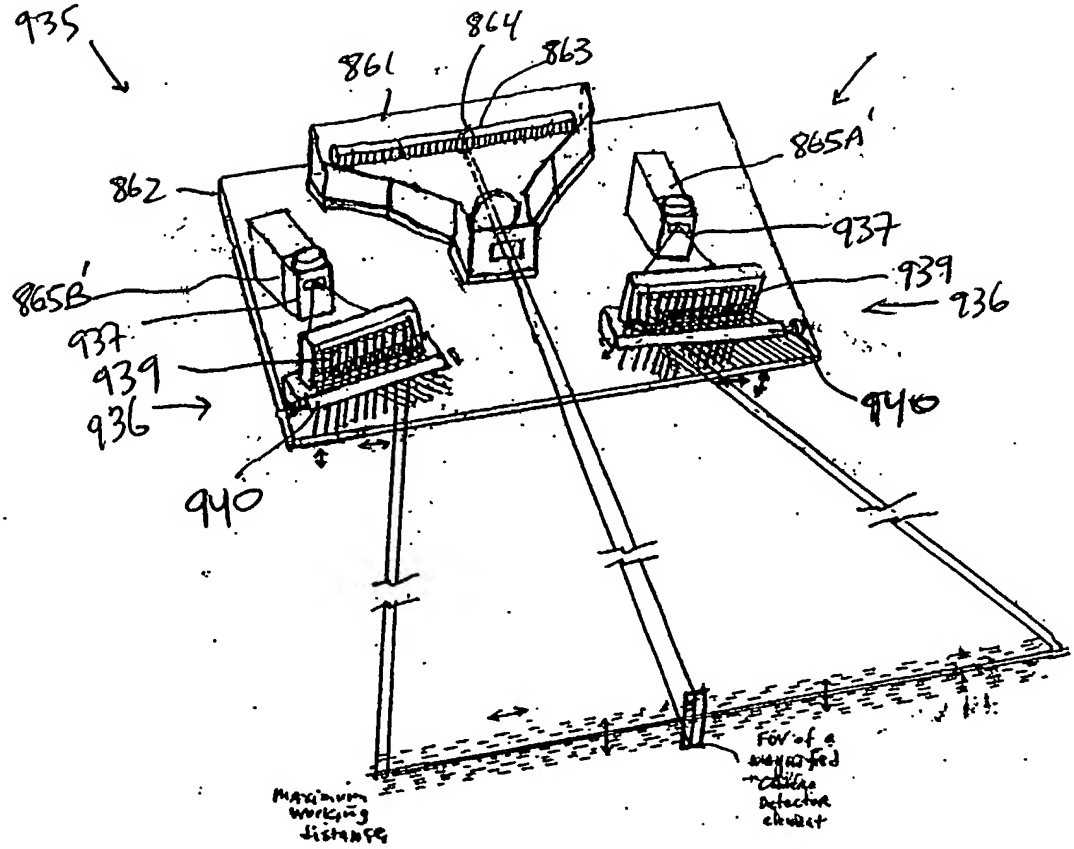


FIG. 1I25H1

* Lateral and Transverse Microoscillation of PLIB

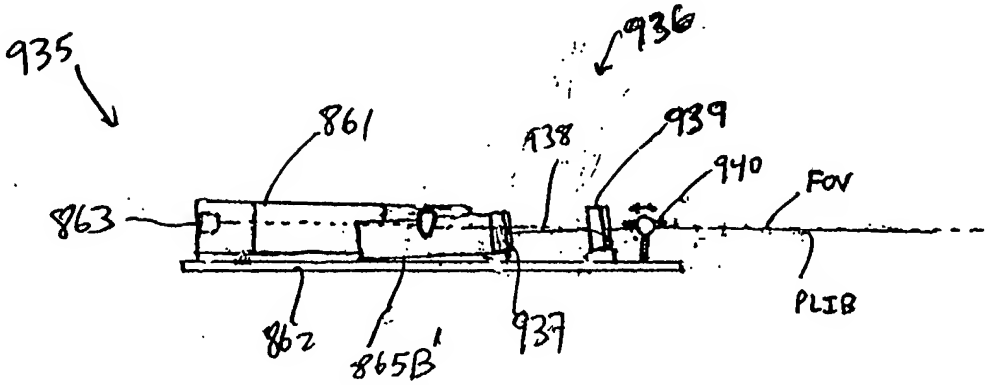


FIG. 1I25H2

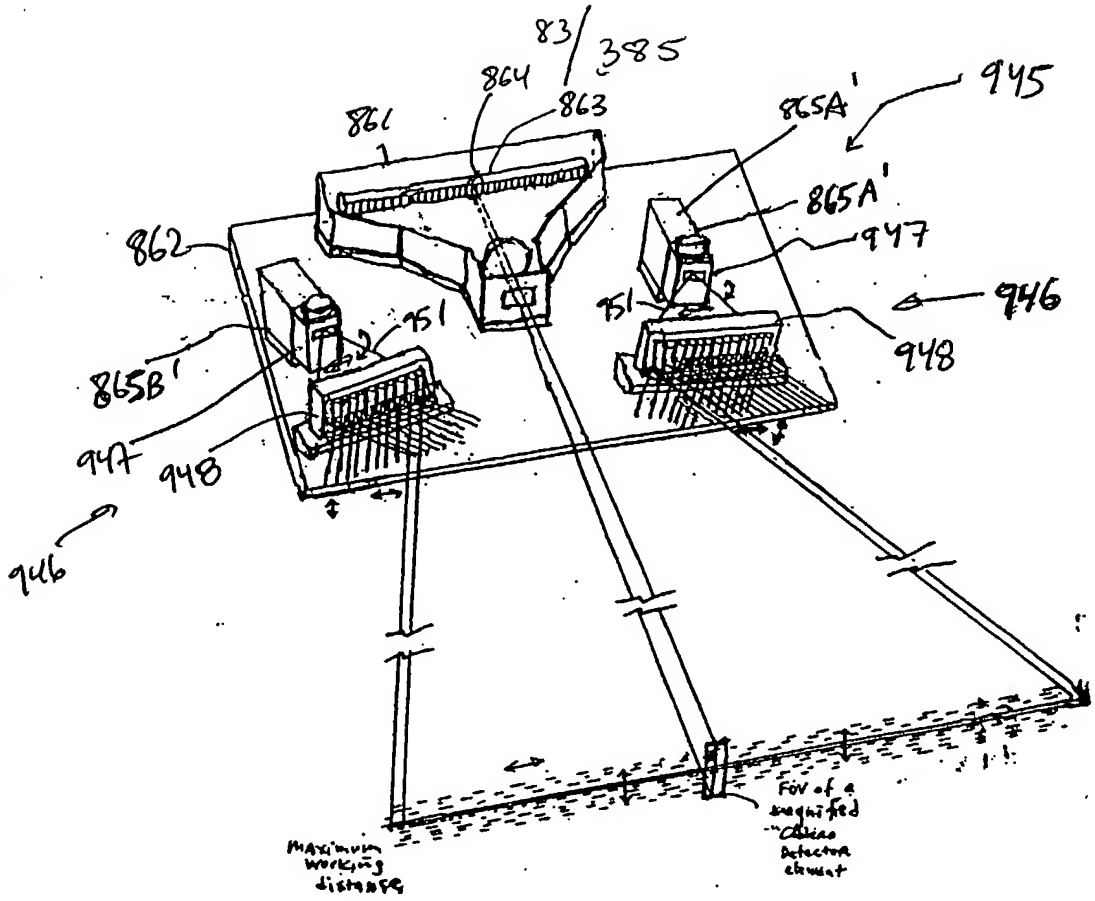


FIG.1I25I1

Lateral and Transverse Microoscillation of PLIB

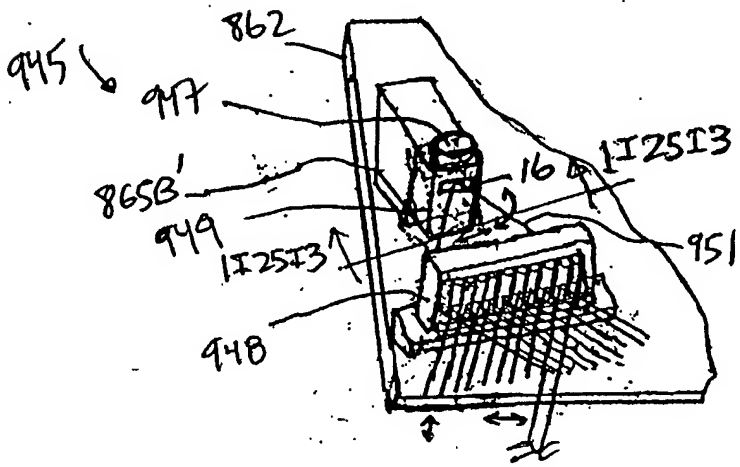


FIG.1I25I2

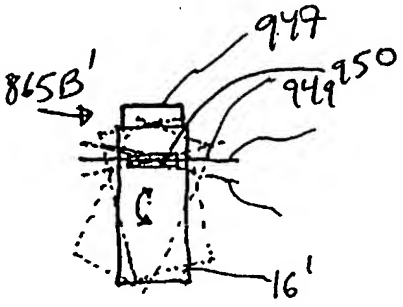


FIG.1I25I3

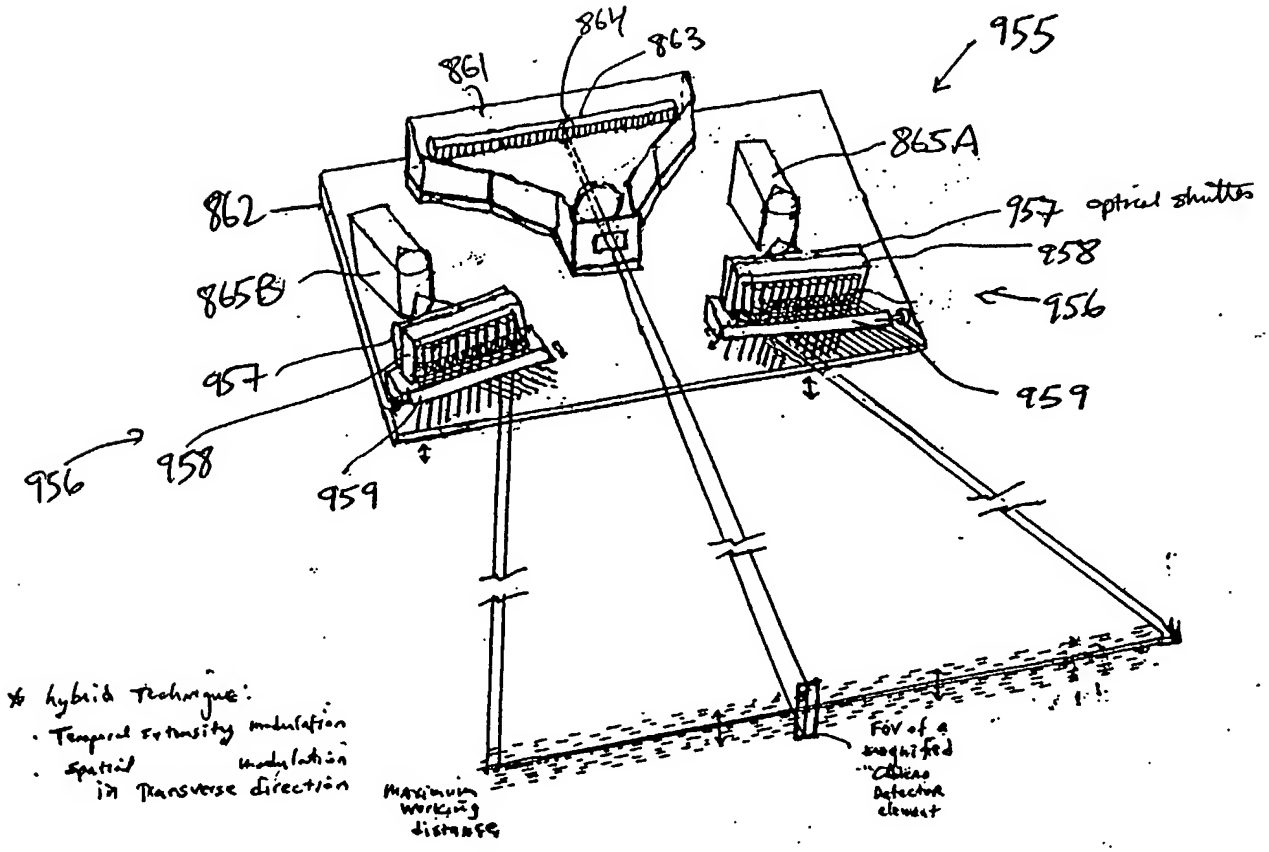


FIG. 1I25J1

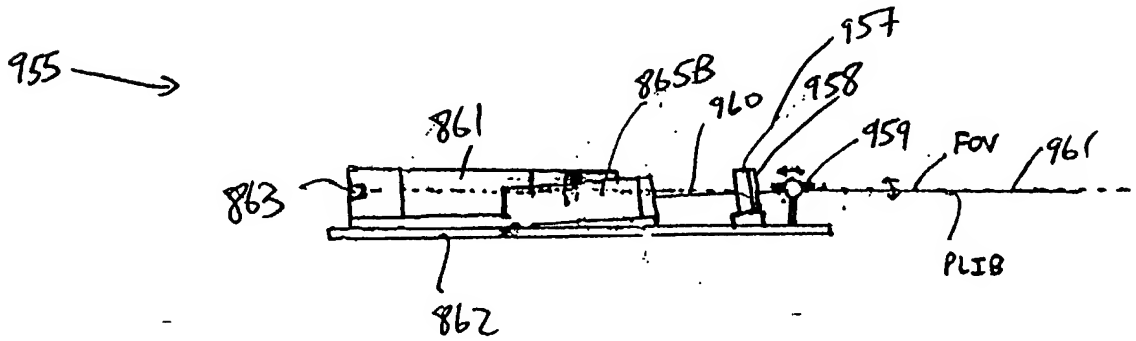


FIG. 1I25J2

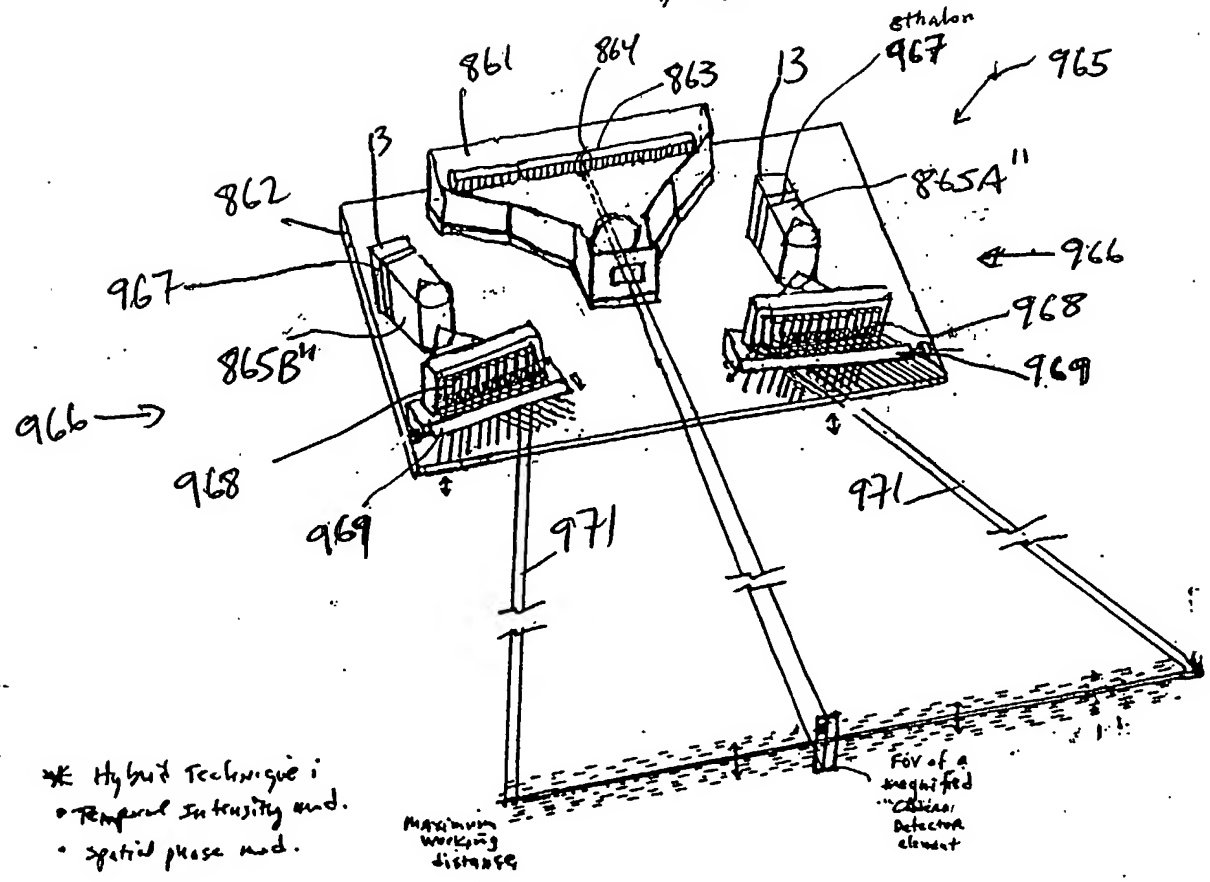


FIG. 1I25K1

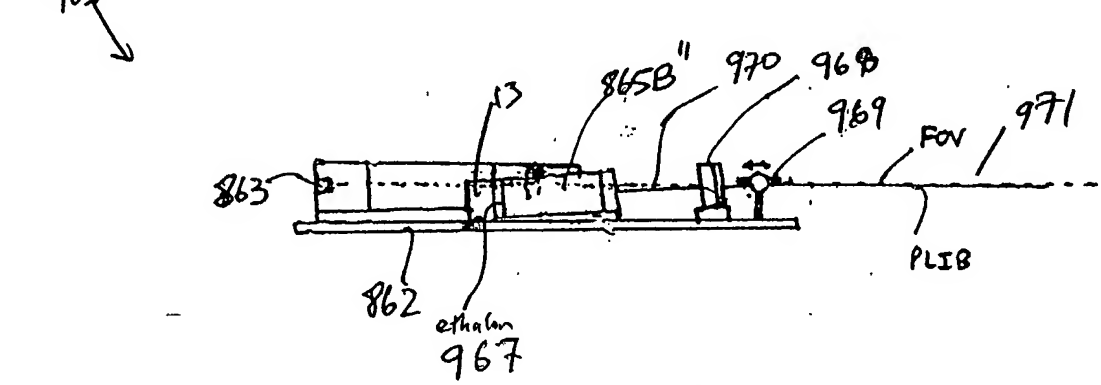
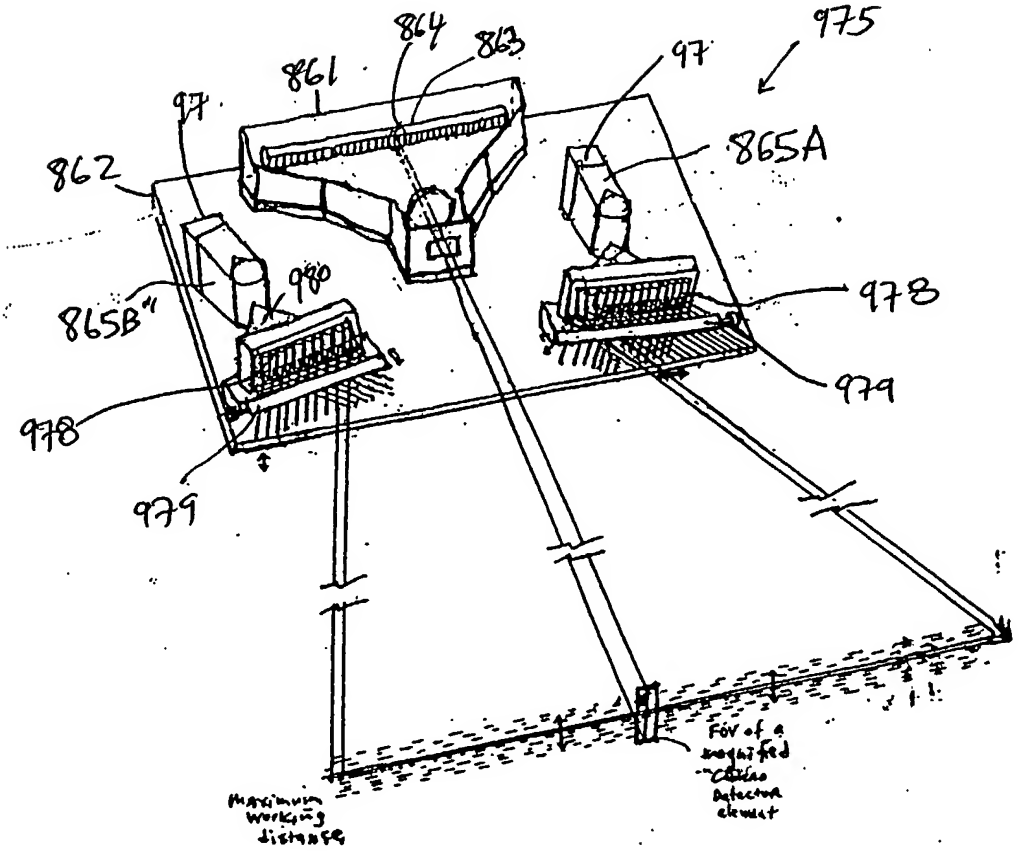


FIG. 1I25K2



* hybrid :
  + Temp freq. mod
  + spatial phase mod.
* Transverse micro-oscillation of PLIB

FIG. 1I25L1

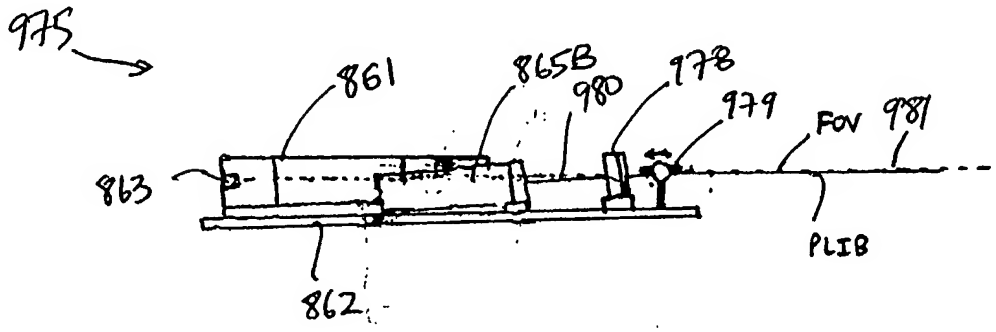
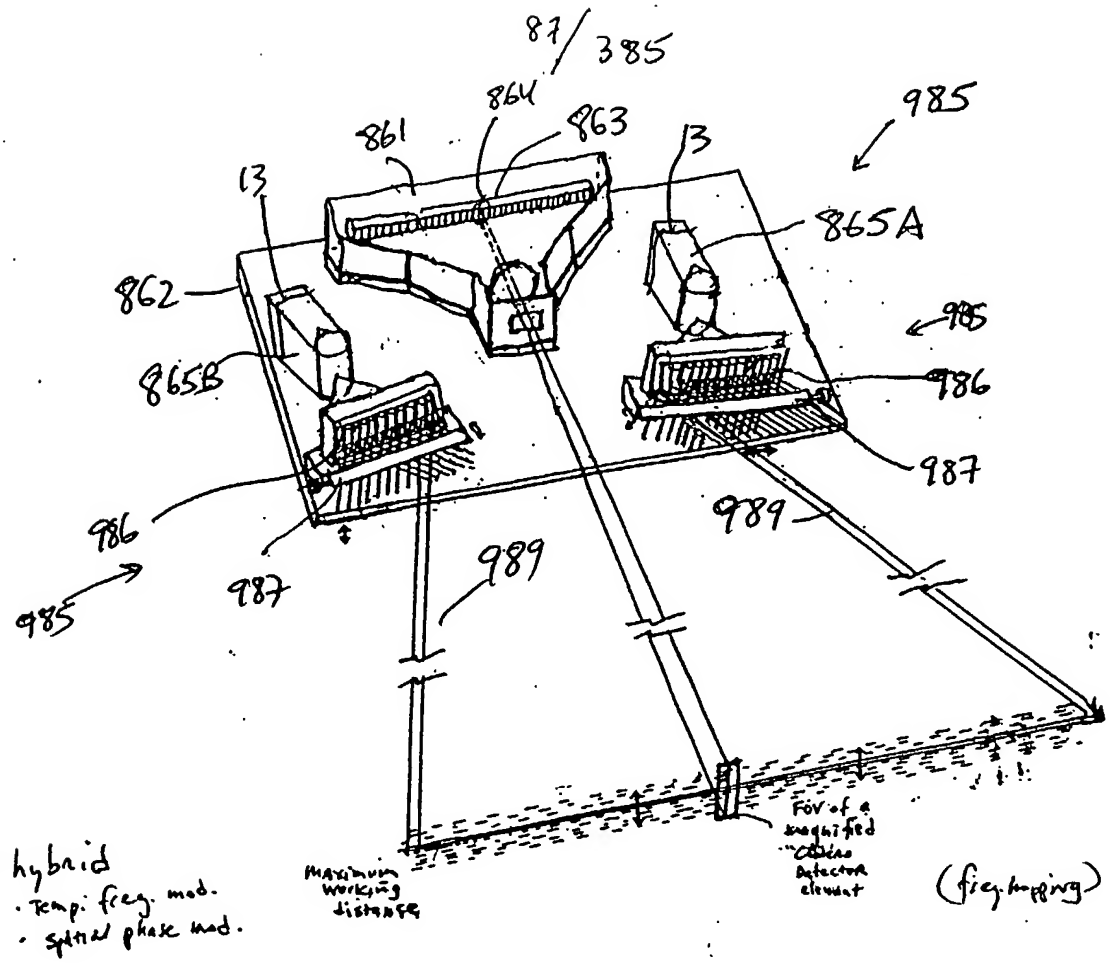


FIG. 1I25L2



* hybrid
- Temp. freq. mod.
- Spatial phase mod.

FIG. 1I25M1

* Transverse microoscillation of PLIB

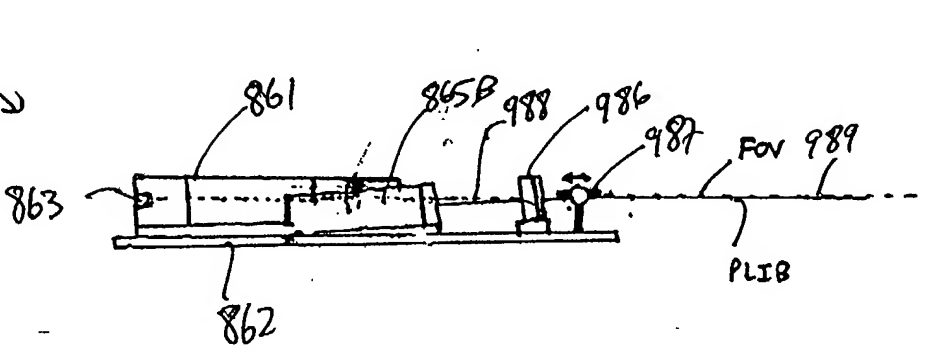
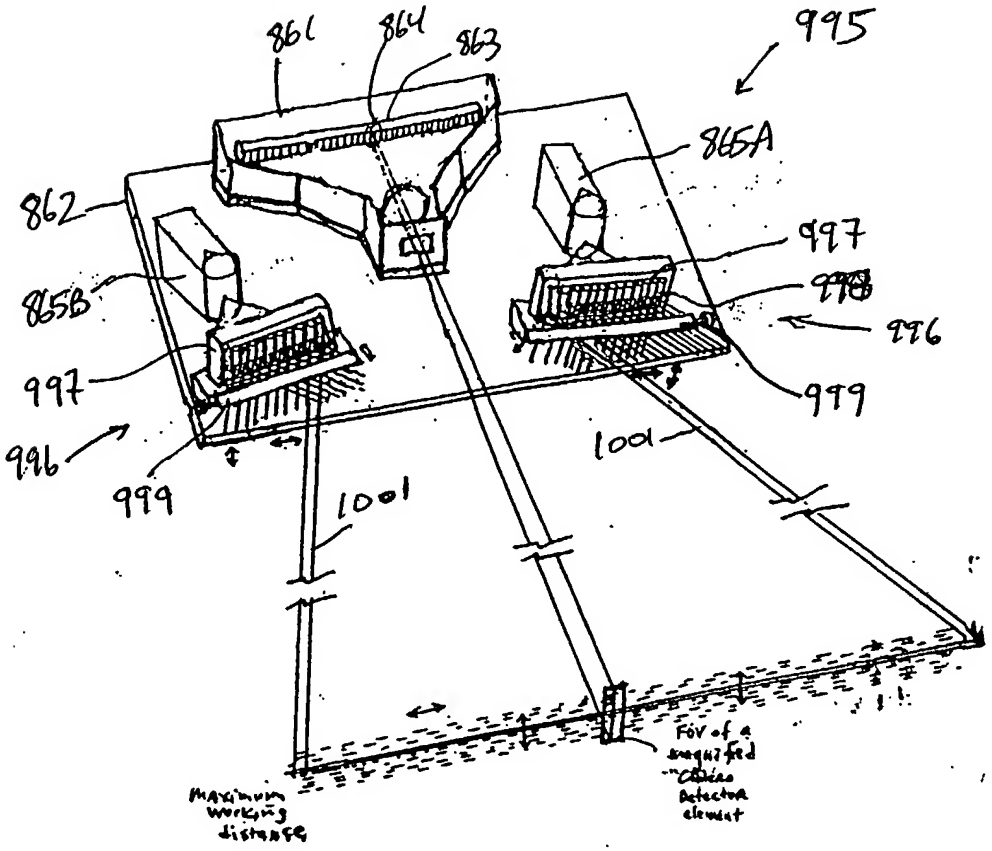


FIG. 1I25M2



* hybrid:
  - spatial intensity mod.
  - spatial phase
* Lateral and Transverse Microoscillation of PLIB

FIG. 1I25N1

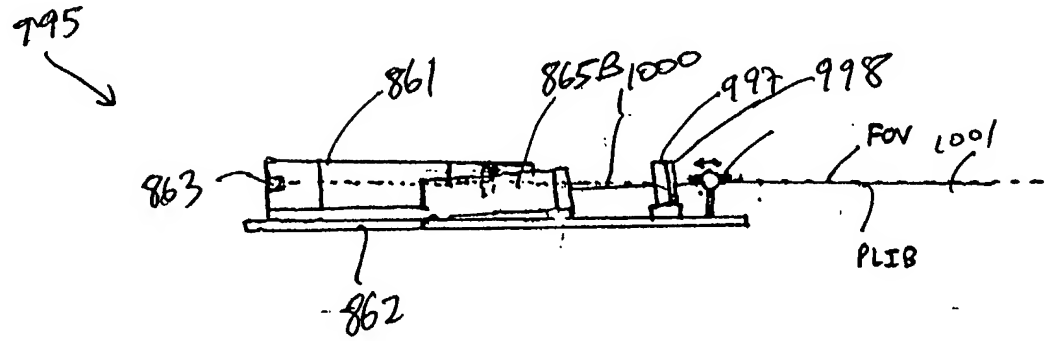


FIG. 1I25N2

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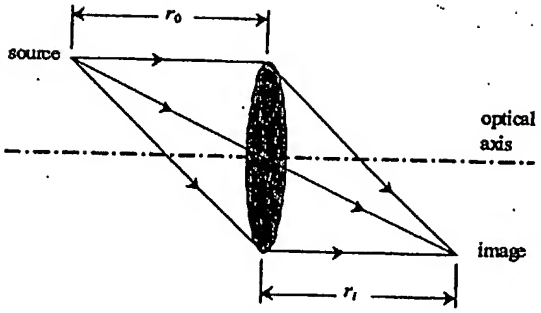

FIG. 1H1

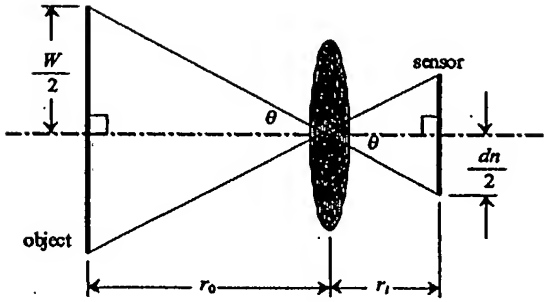

FIG. 1H2

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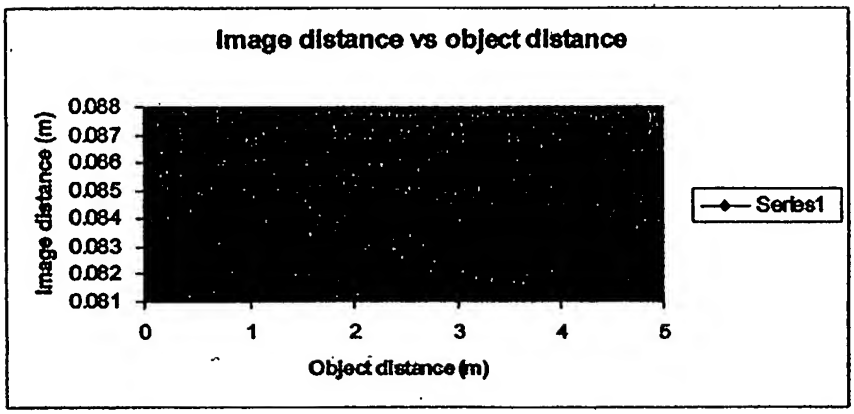

FIG. 1H3

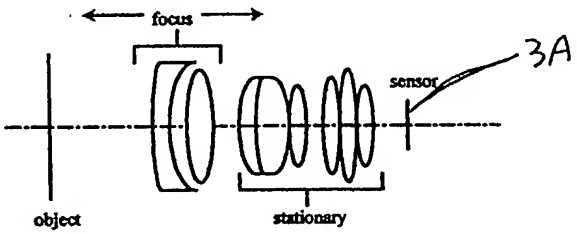

FIG. 1H4

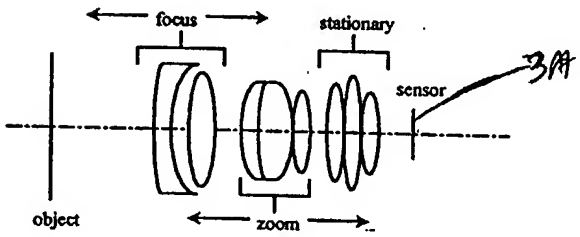

FIG. 1H5

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Fixed focal length lens cases

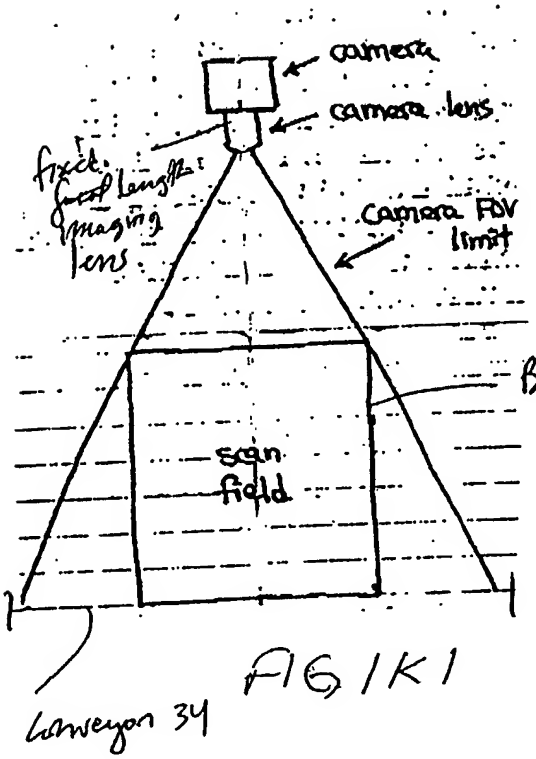

FIG 1K1

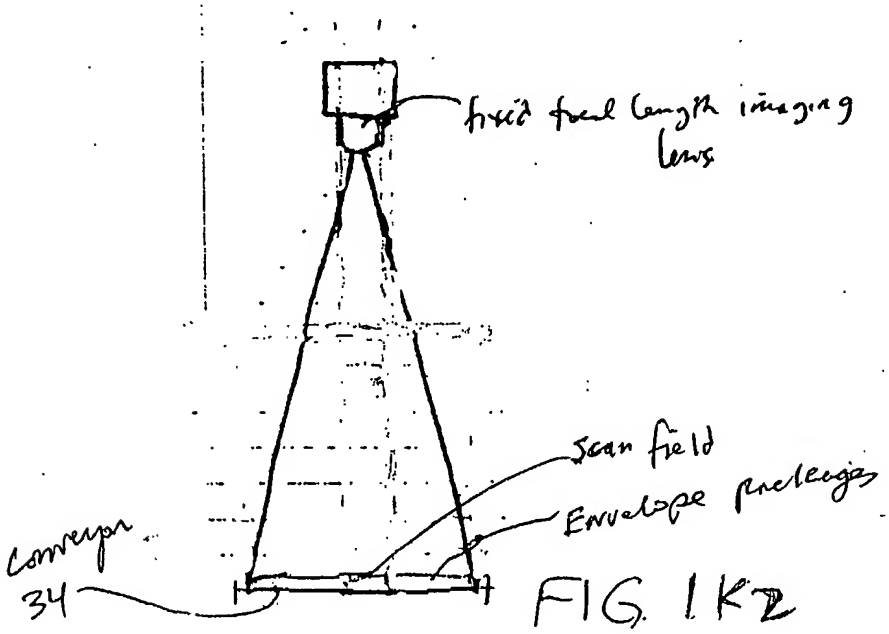

FIG. 1K2

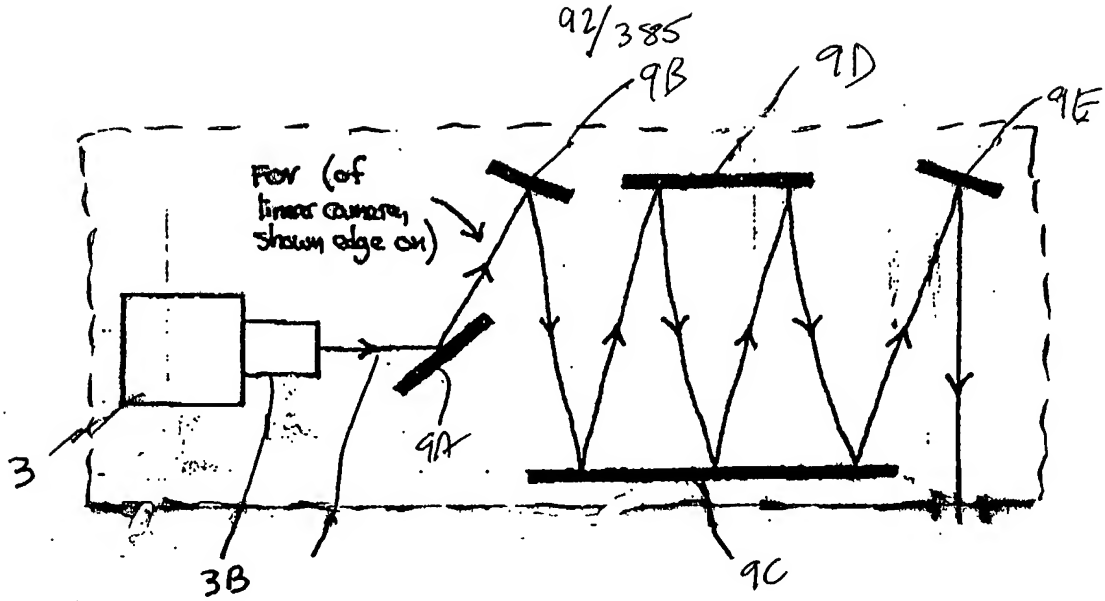

FIG. 1L1

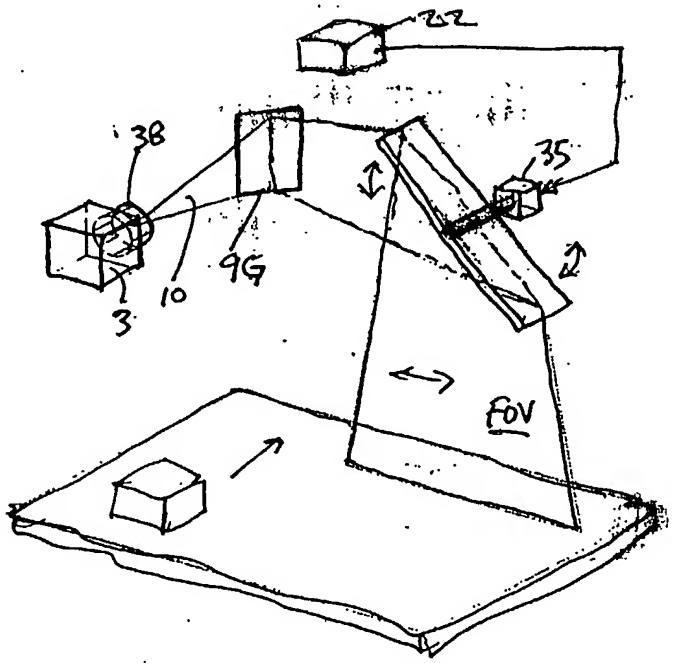

FIG. 1L2

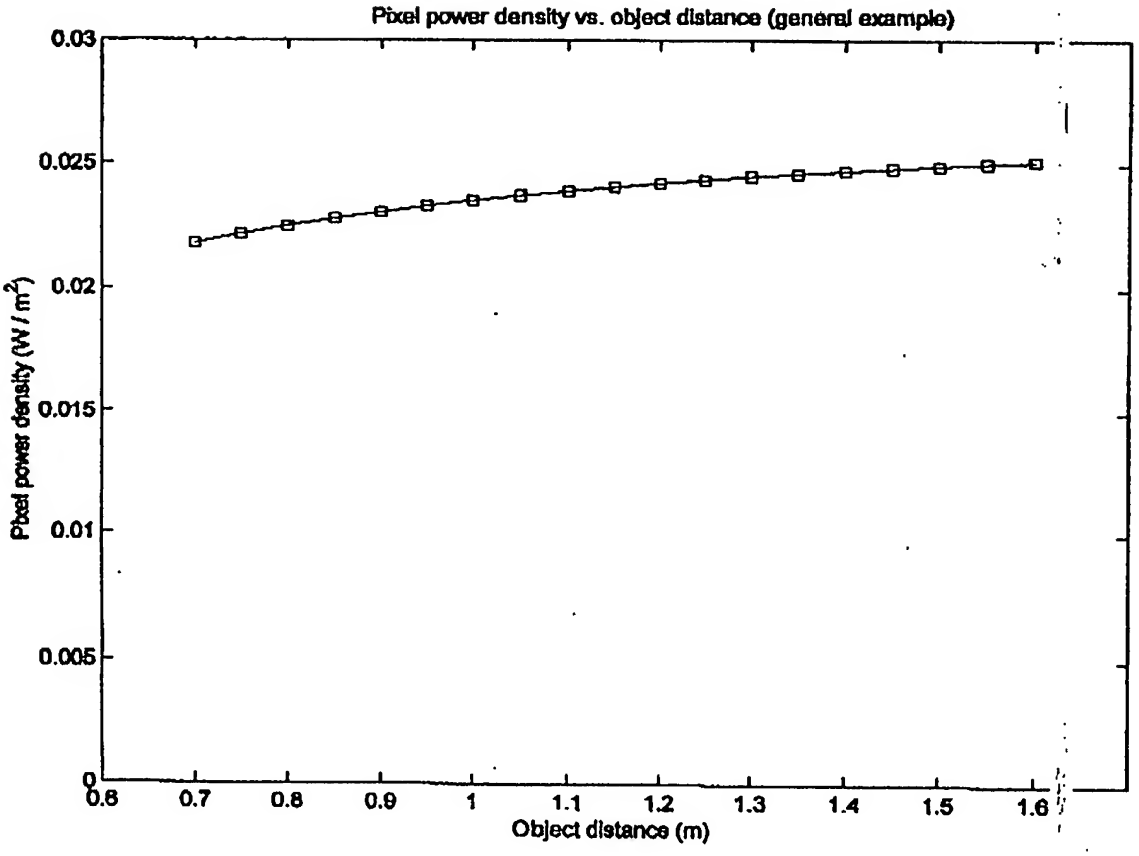
Pixel power density vs. object distance (general example)
Pixel power density (W / m^2)
0.03
0.025
0.02
0.015
0.01
0.005
0
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
Object distance (m)

FIG. 1M1

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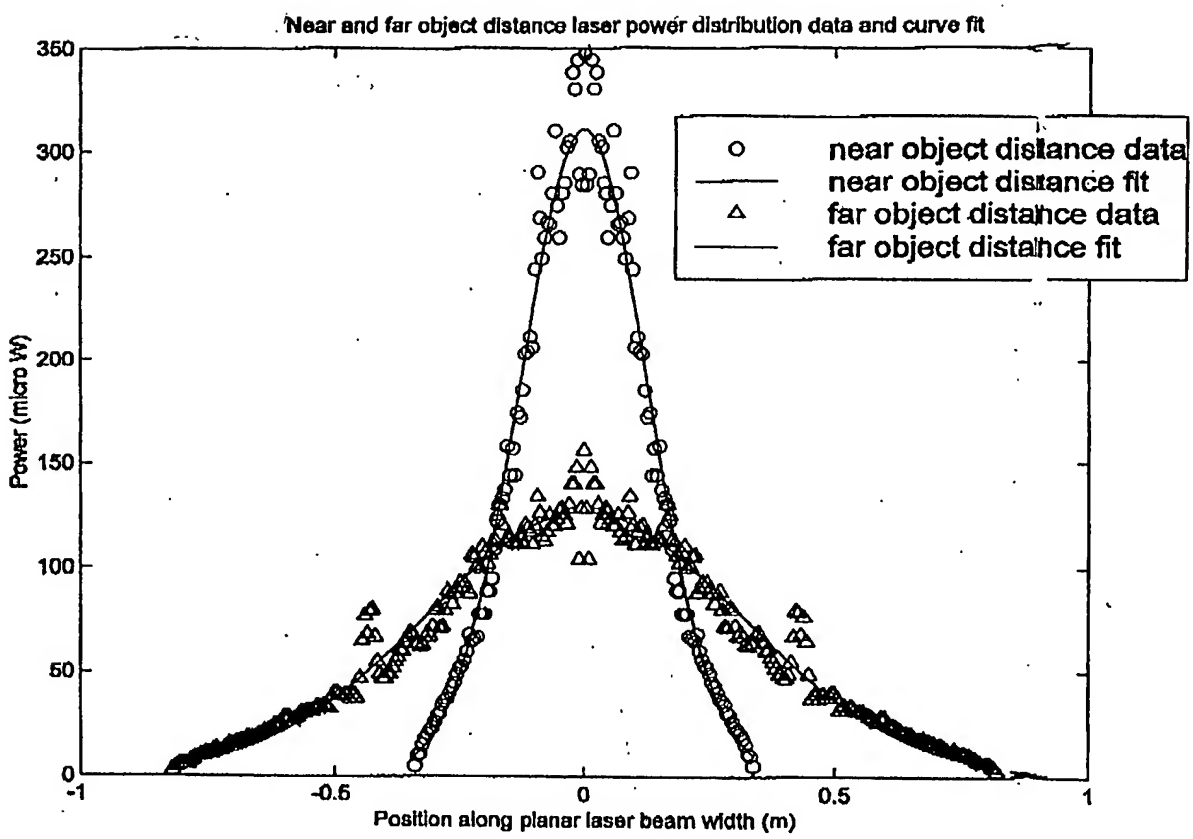

FIG. 1M2

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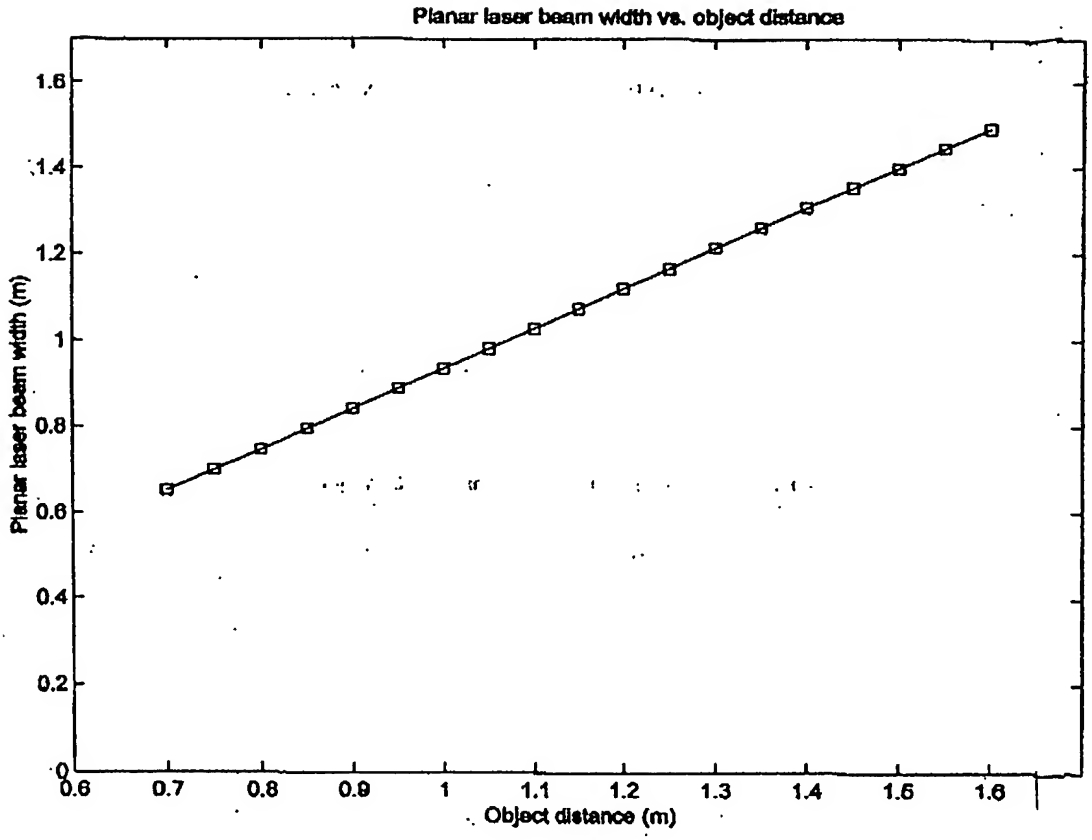

FIG. 1M3

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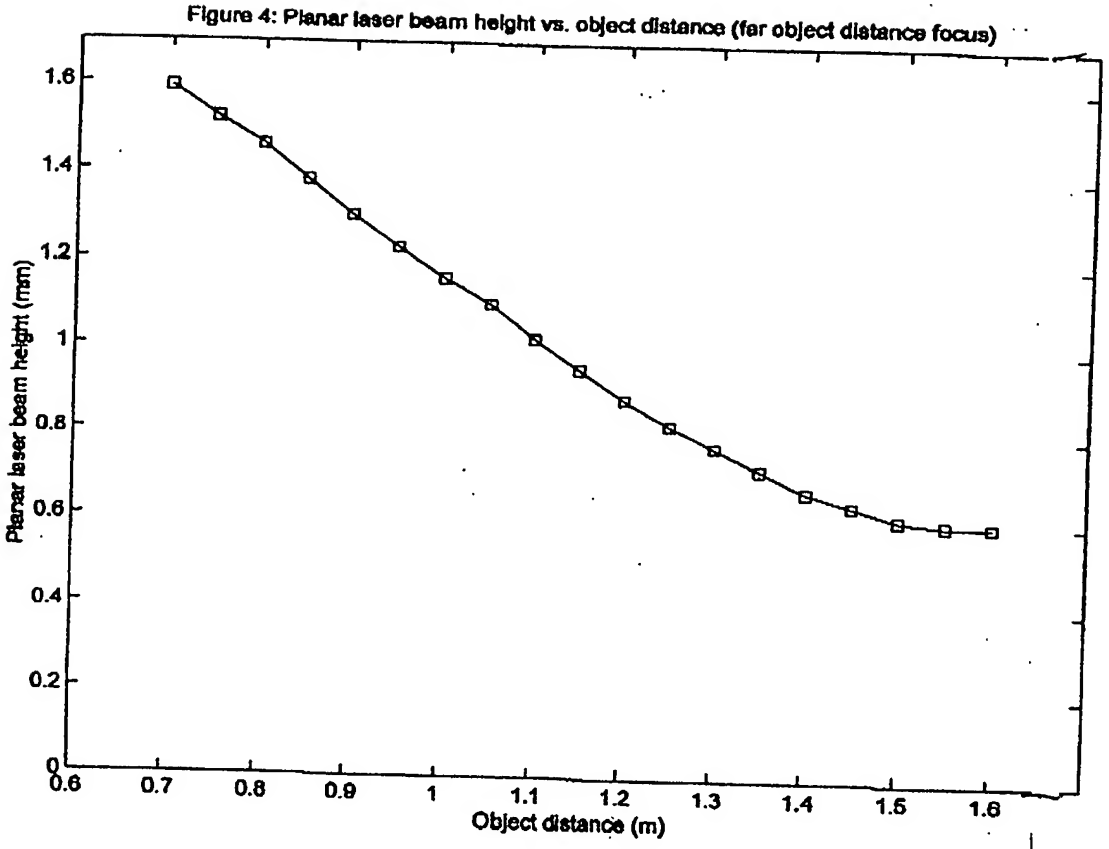
Figure 4: Planar laser beam height vs. object distance (far object distance focus)
Planar laser beam height (mm)
Object distance (m)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6

FIG. 14

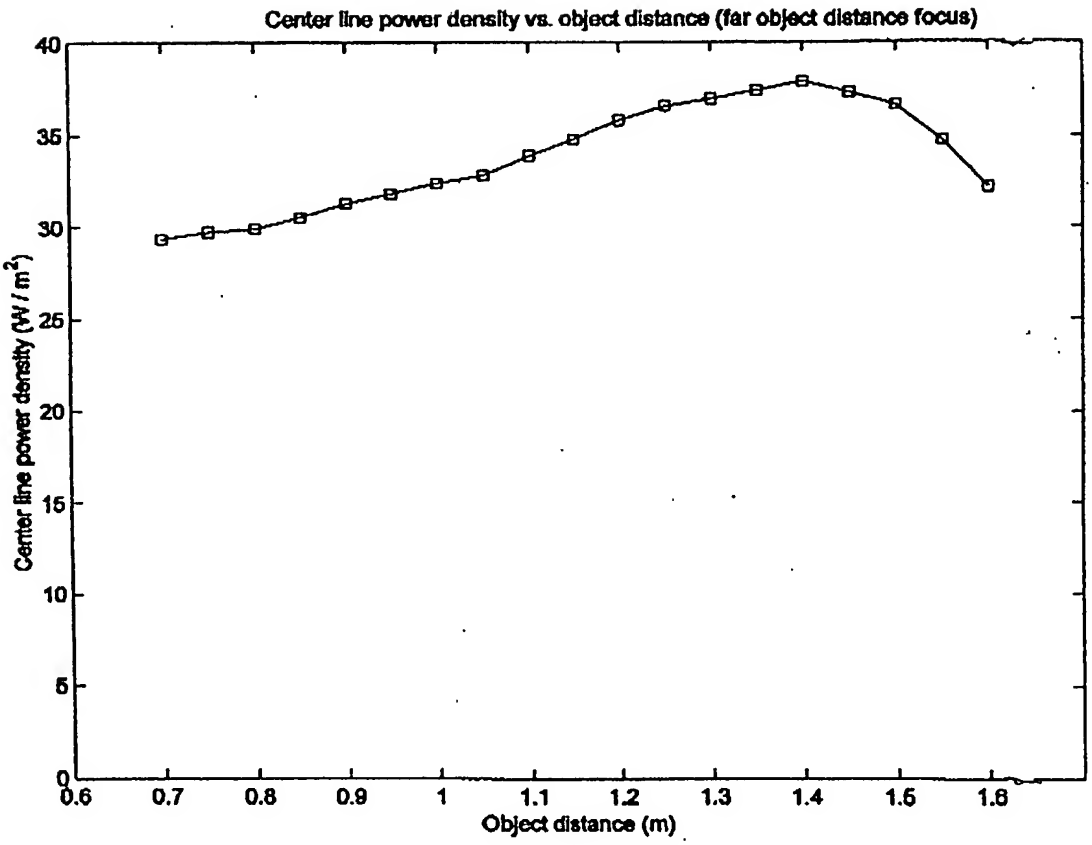
Center line power density vs. object distance (far object distance focus)
Center line power density (W / m²)
Object distance (m)
0
5
10
15
20
25
30
35
40
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6

FIG. 1N

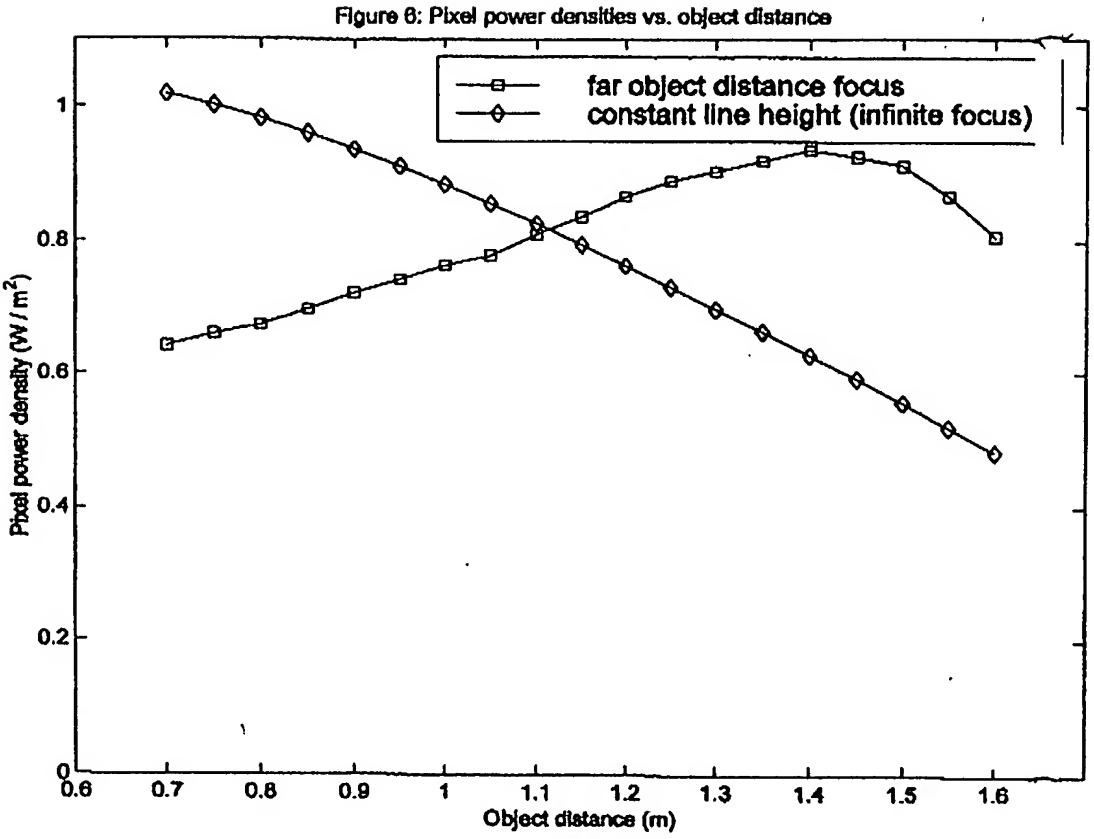
Figure 6: Pixel power densities vs. object distance
far object distance focus
constant line height (infinite focus)
Pixel power density (W / m²)
Object distance (m)
0
0.2
0.4
0.6
0.8
1
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6

FIG. 10

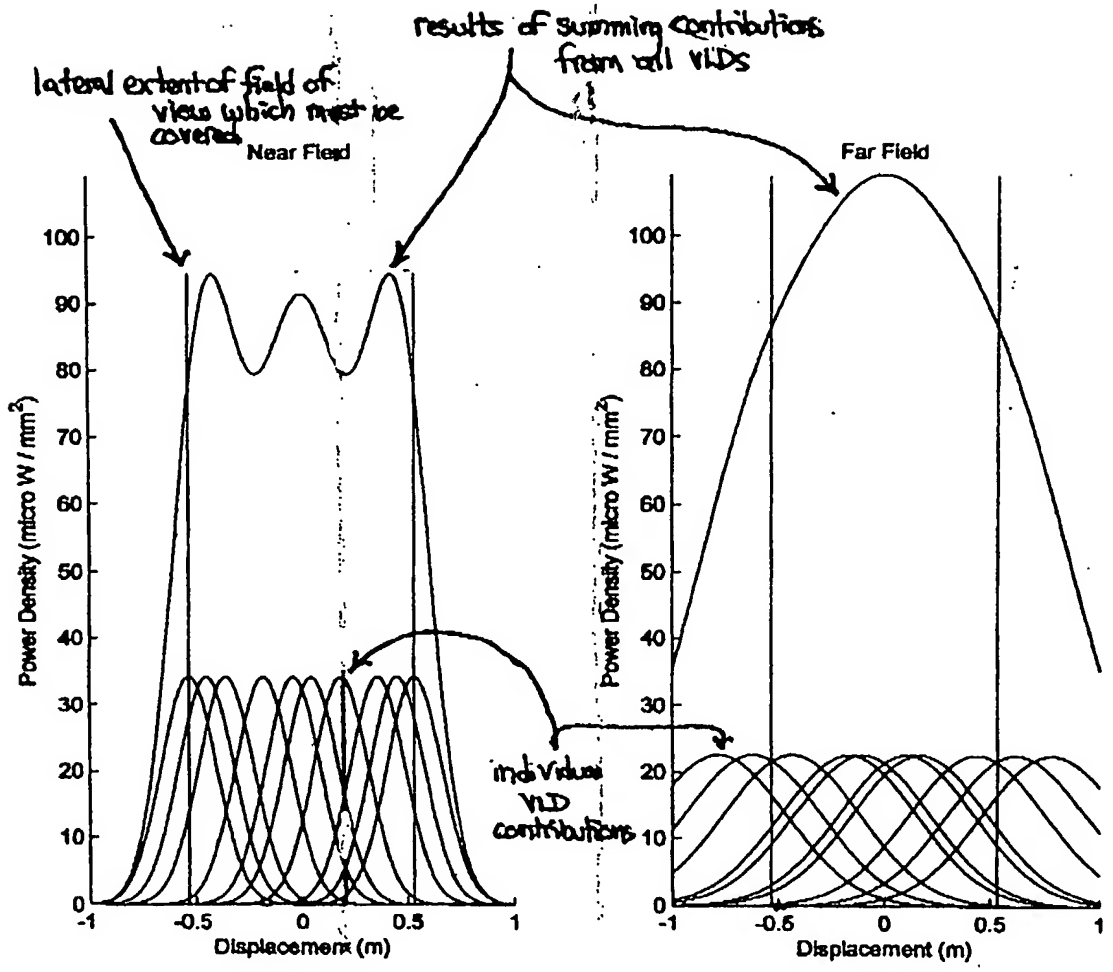

FIG 1P1

FIG 1P2

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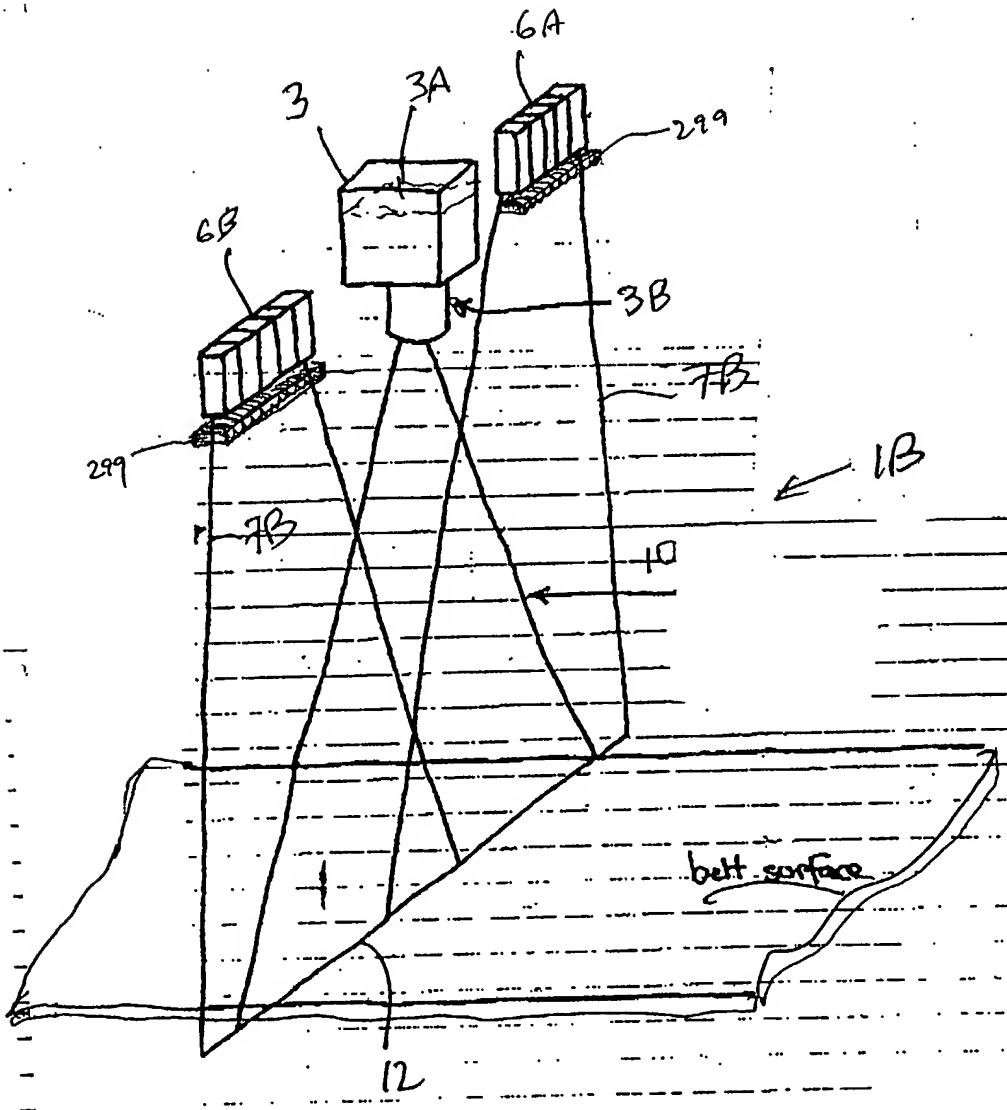

FIG. 1Q1

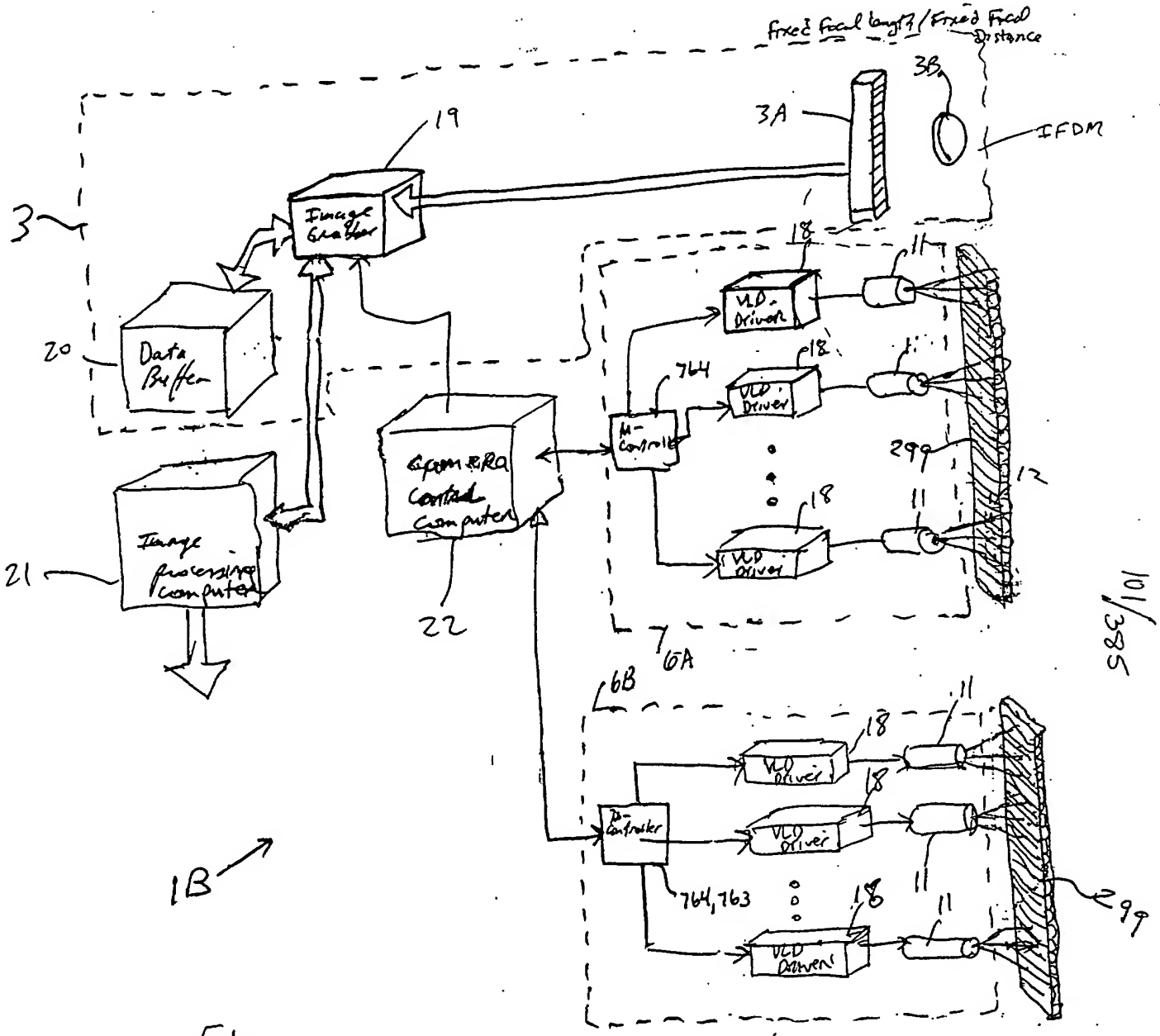

FIG. 1Q2

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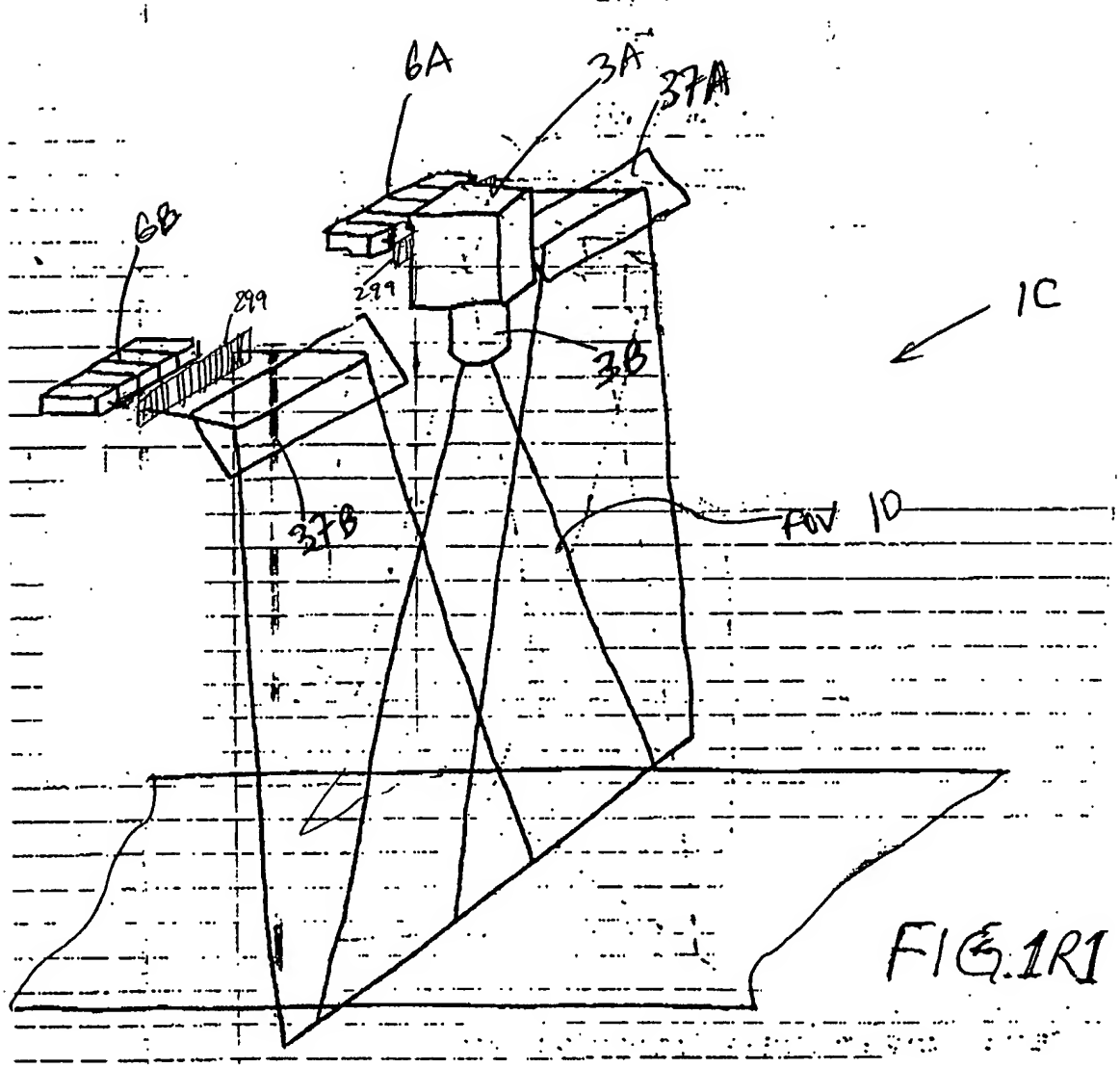
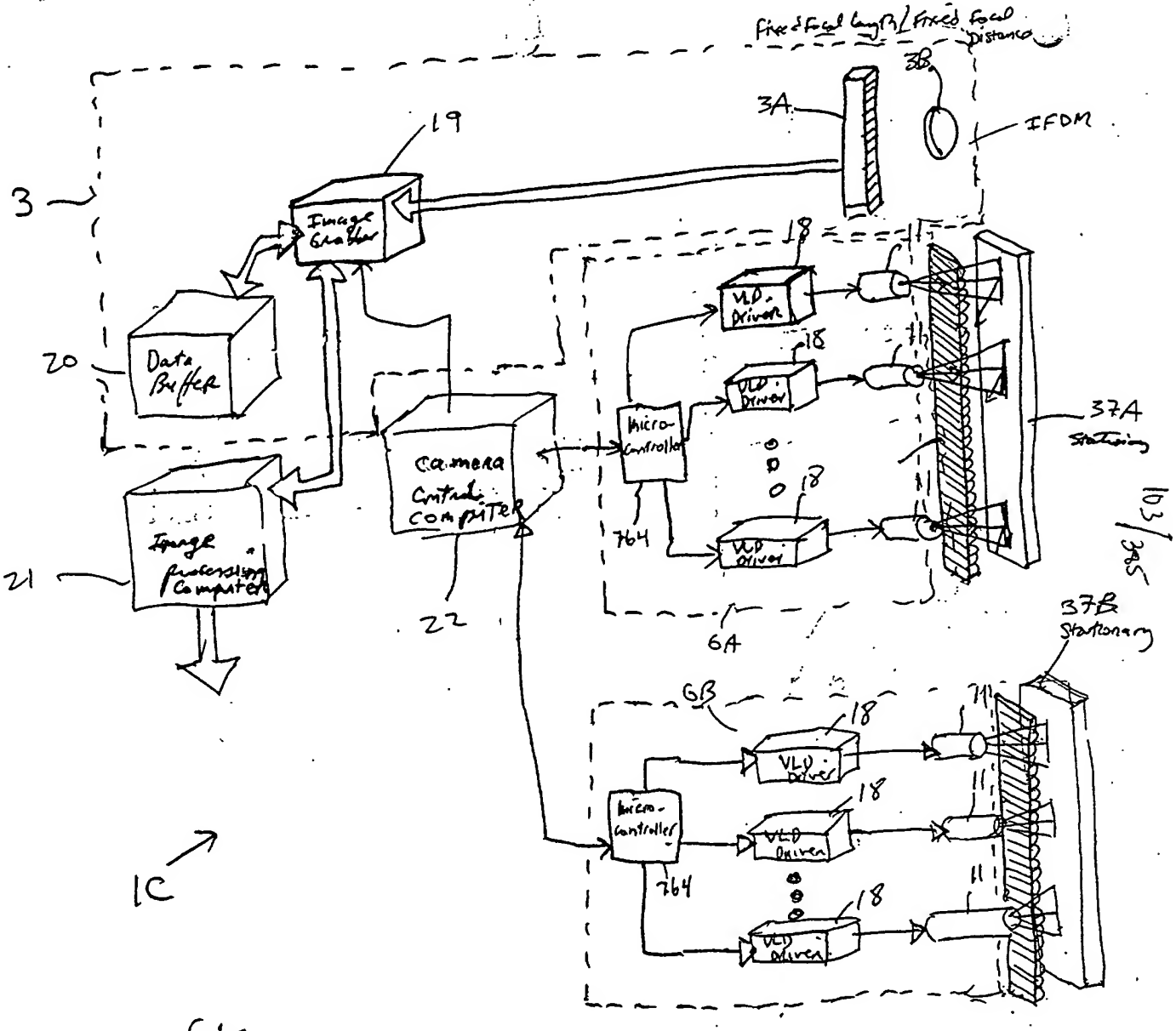


FIG.1R1



FIG, 1R2

20220220° 2254950

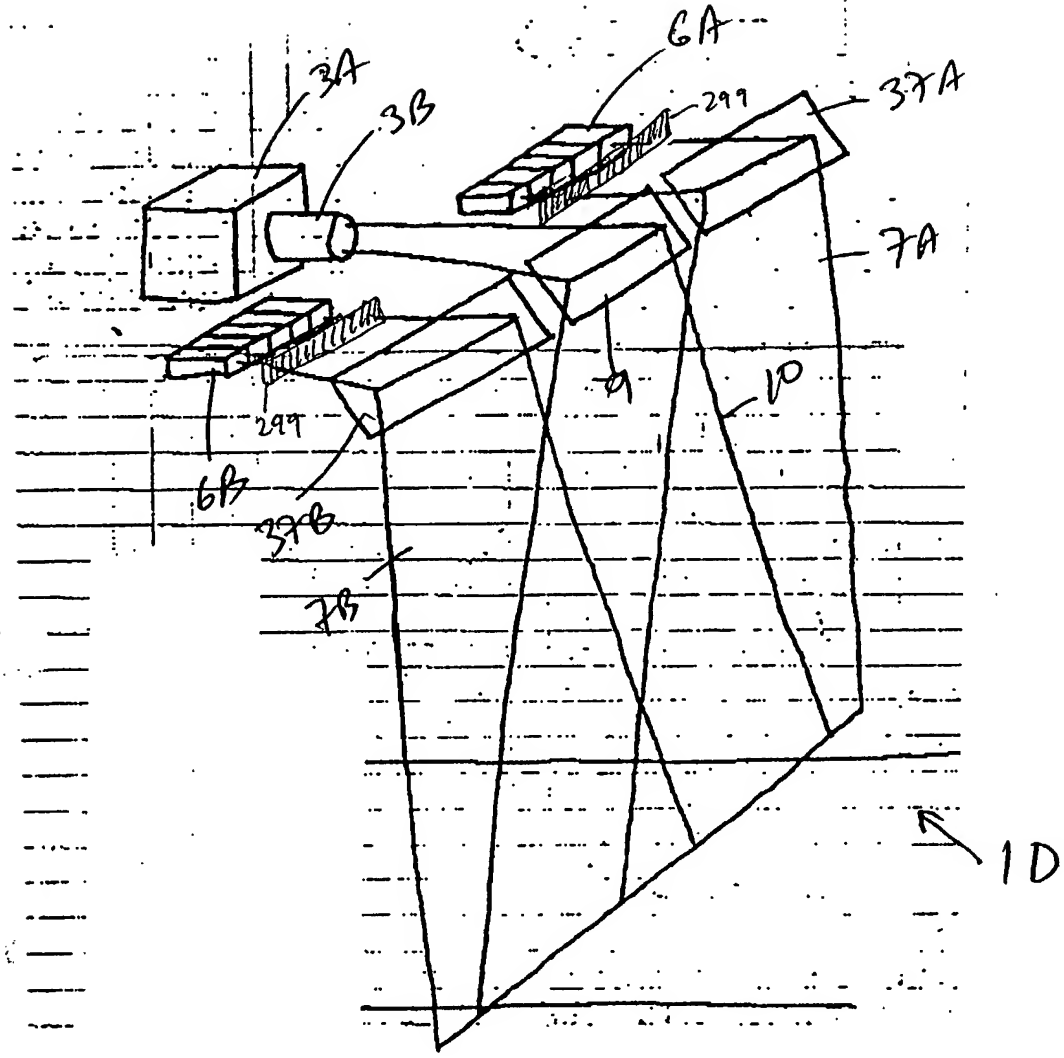


FIG. 1S1

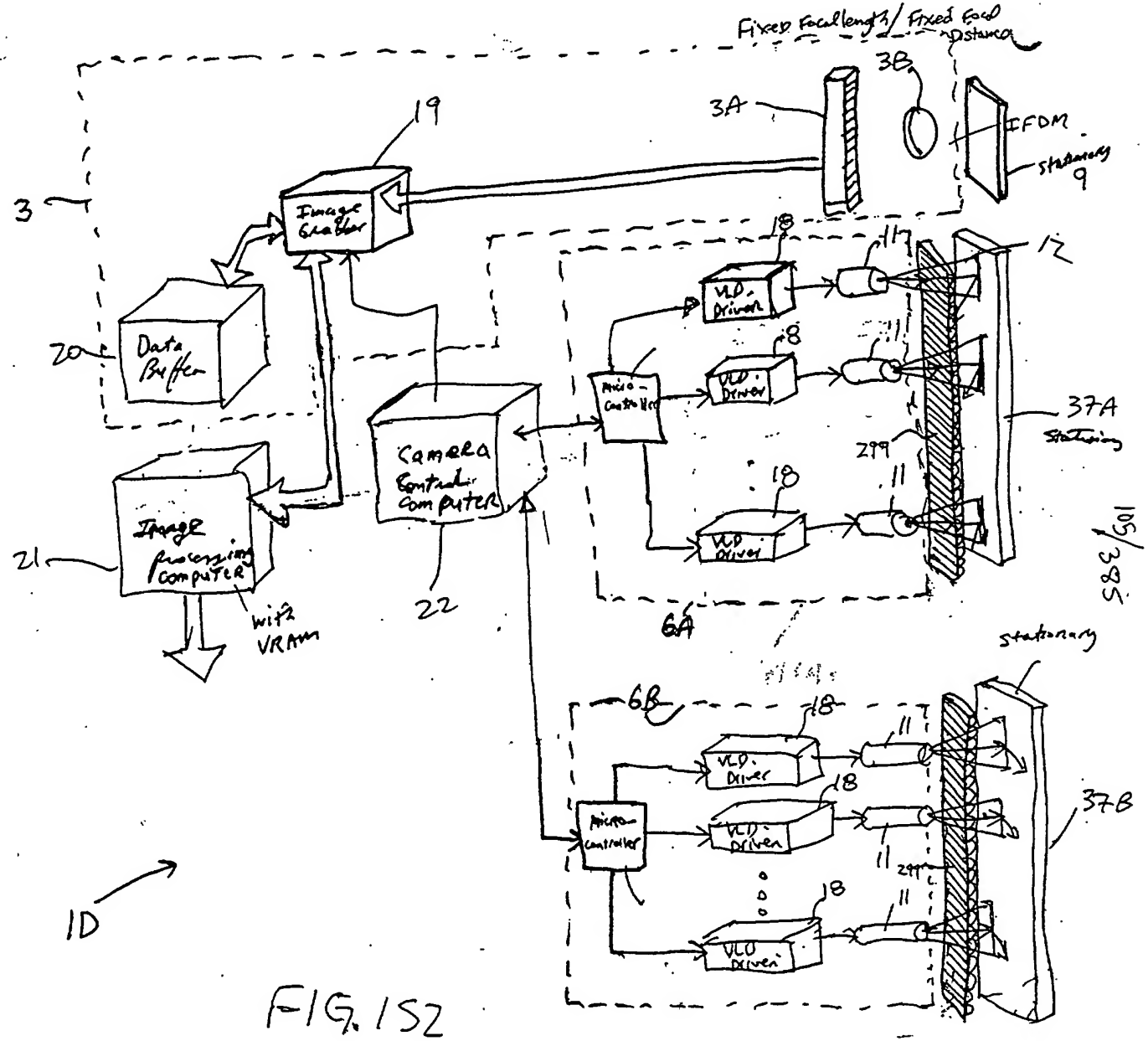

Fixed Focal length / Fixed Focal distance
3B
3A
IFDM
stationary
9
19
3
Image Grabber
18
17
12
VLD Driver
20
Data Buffer
Micro-Controller
37A
Camera Control computer
299
11
Image processing computer
21
with VRAM
22
6A
151
385
stationary
6B
37B
1D

FIG. 1S2

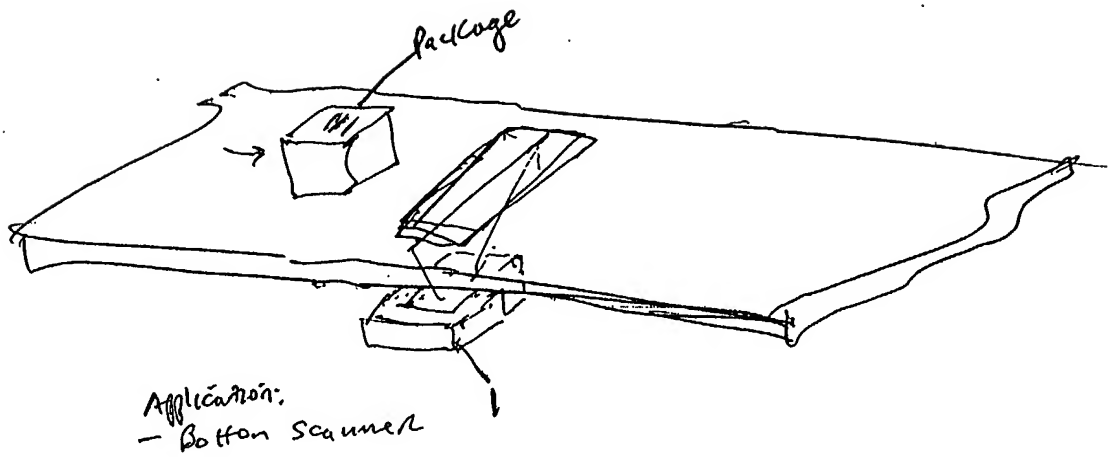


FIG 1T

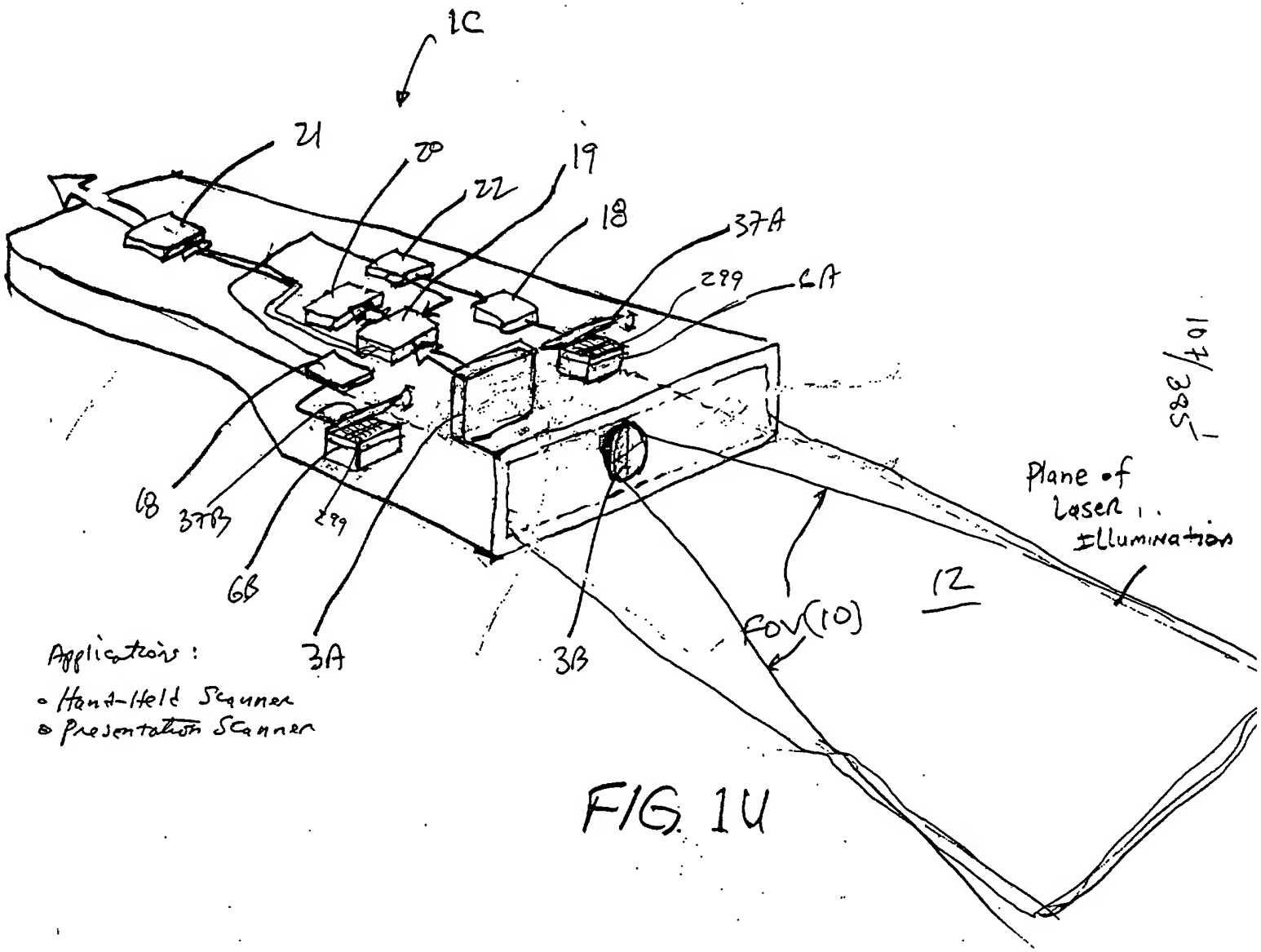


FIG. 1U

20220220.2358.0001

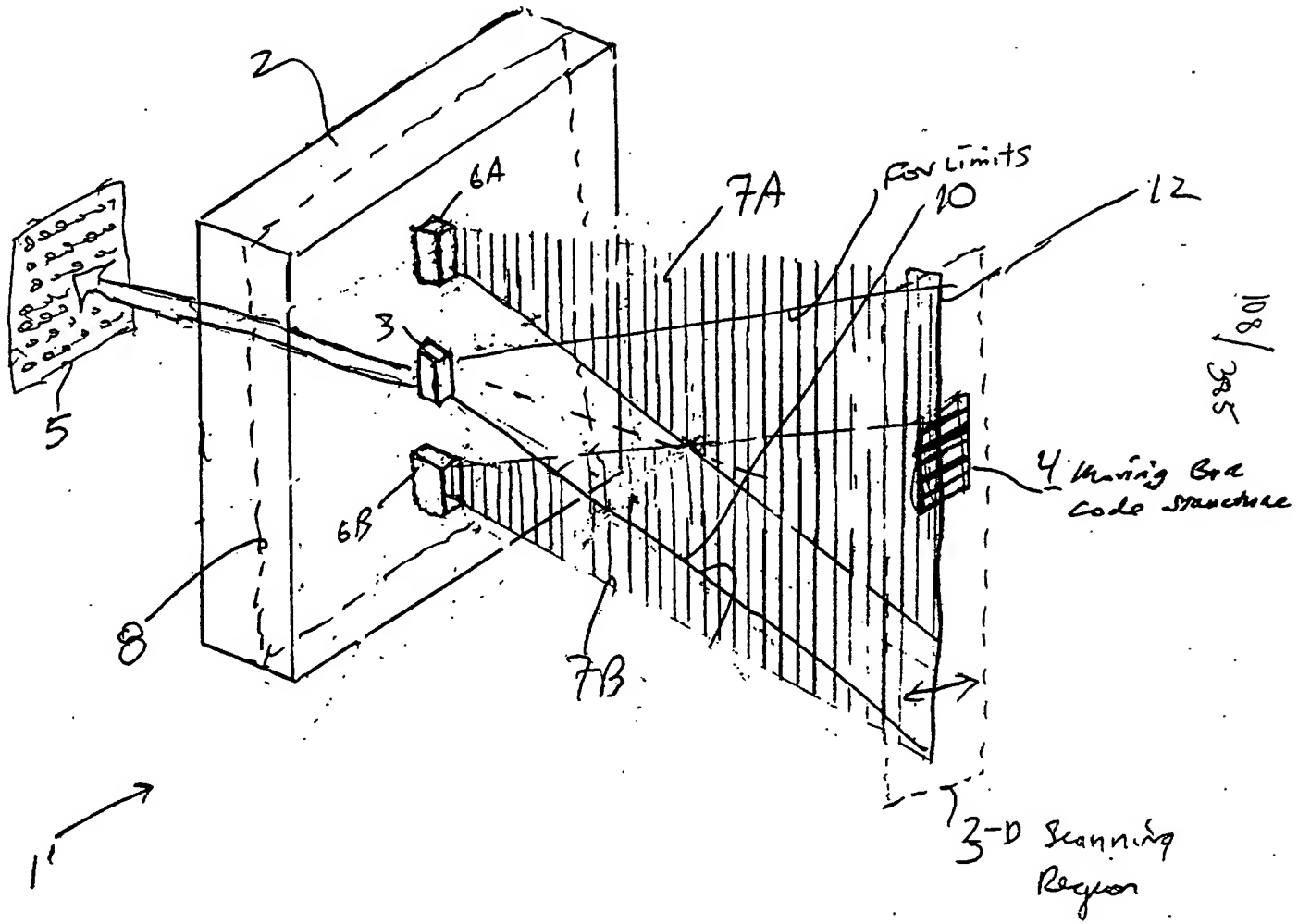


FIG. IVI

US 6,604,682 B2

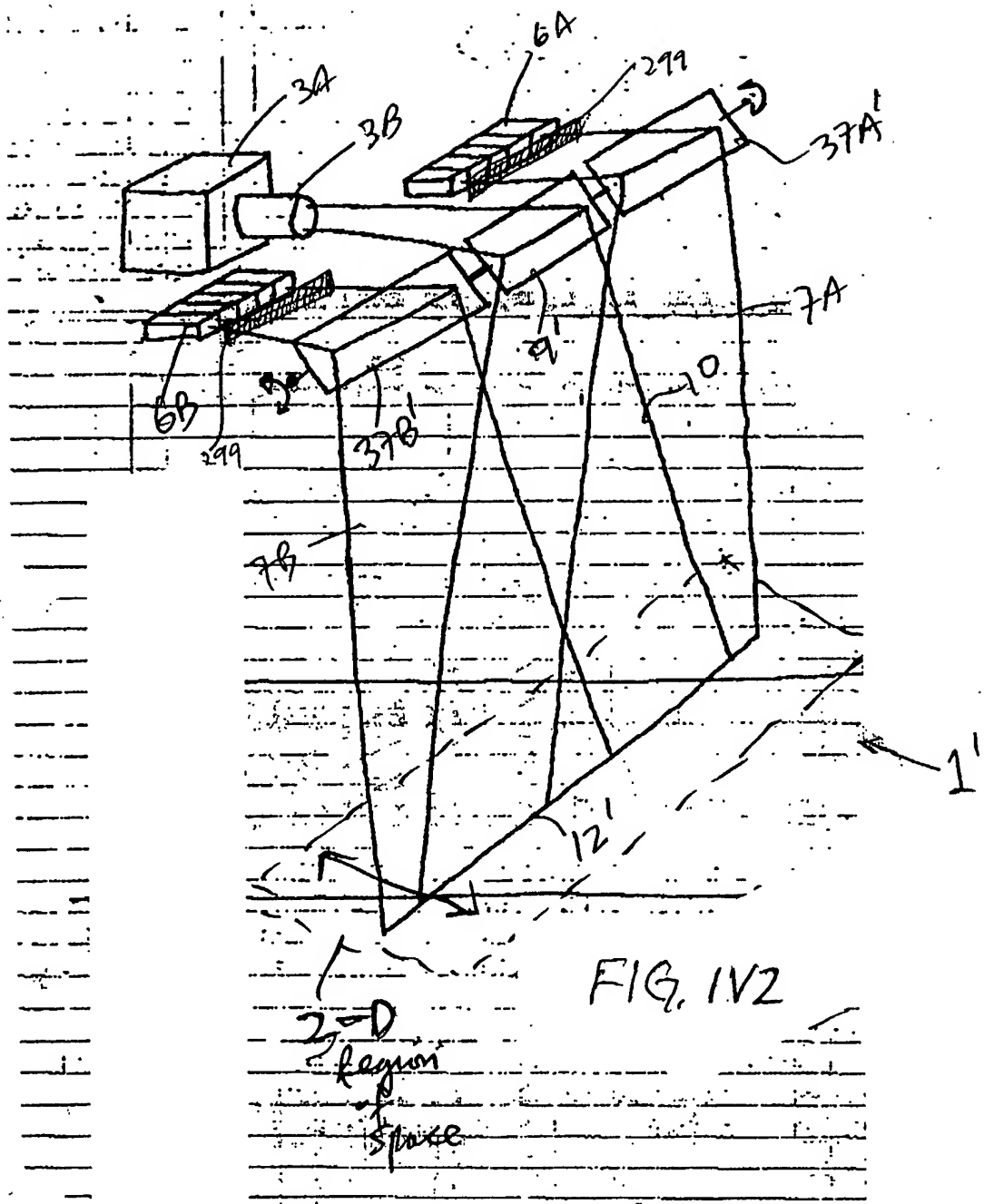


FIG. IV2

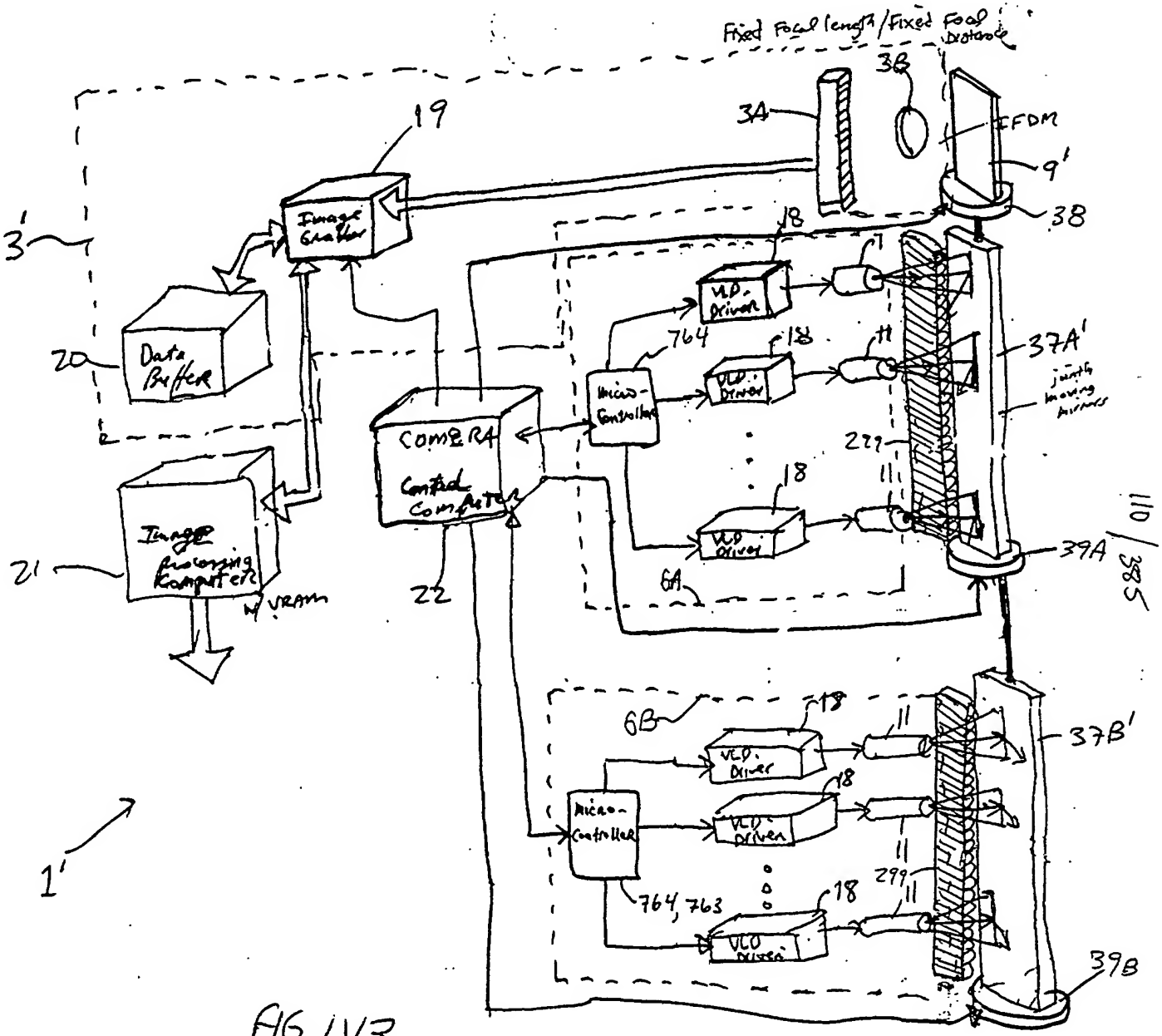
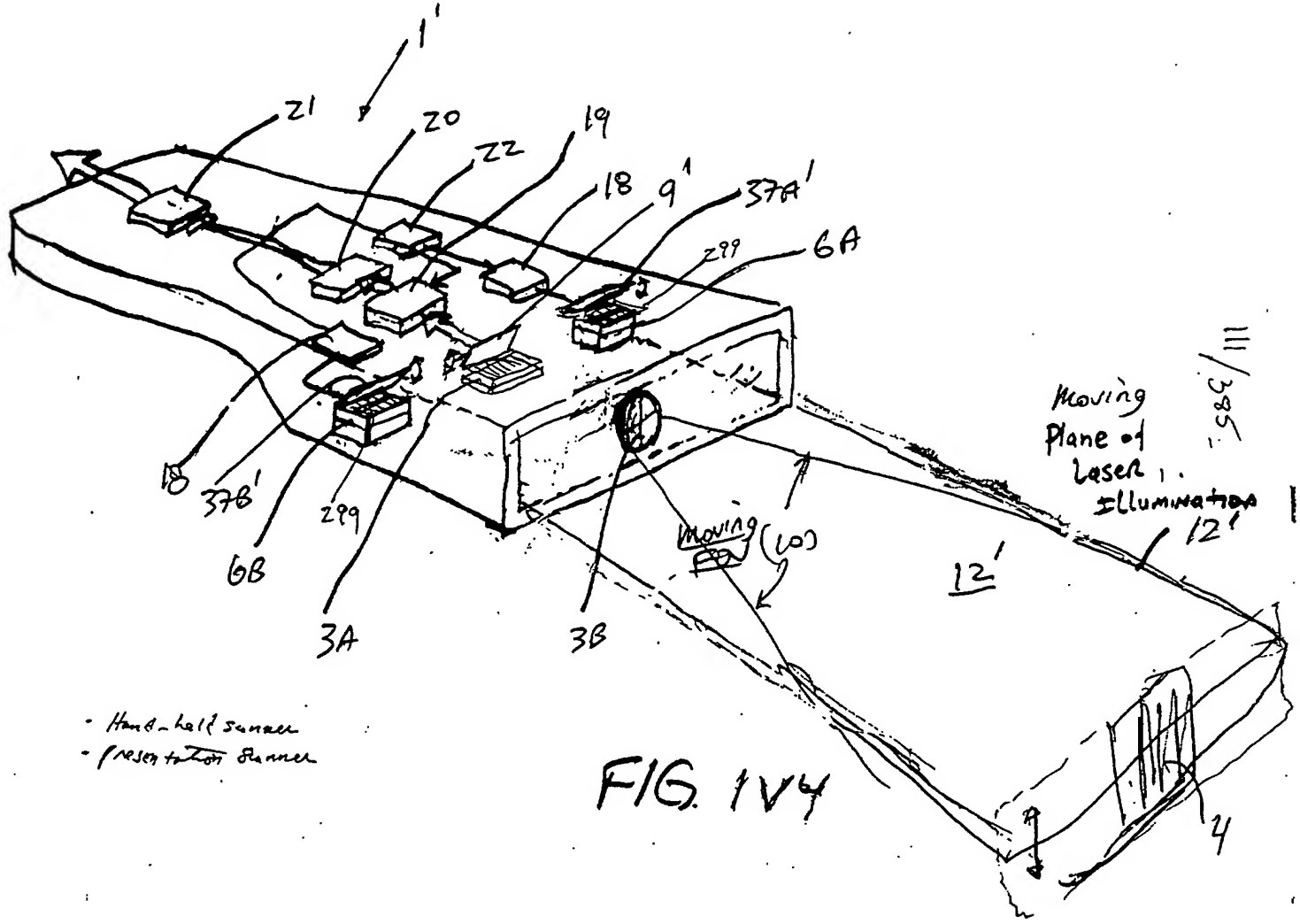

Fixed Focal length/Fixed Focal Distance
3B
3A
FFDM
9'
38
19
Image Grabber
3'
18
VLD driver
764
Micro-Controller
37A'
Joints moving mirrors
20
Data Buffer
COMERA
Control Computer
18
11
299
21
Image processing Computer
VRAM
22
6A
39A
110
385
6B
37B'
764, 763
39B
1'

FIG. 1V3



- Hand-held scanner
- Presentation Scanner

FIG. 1V4

20220207.1283.0 - 2022-02-07 13:30:07

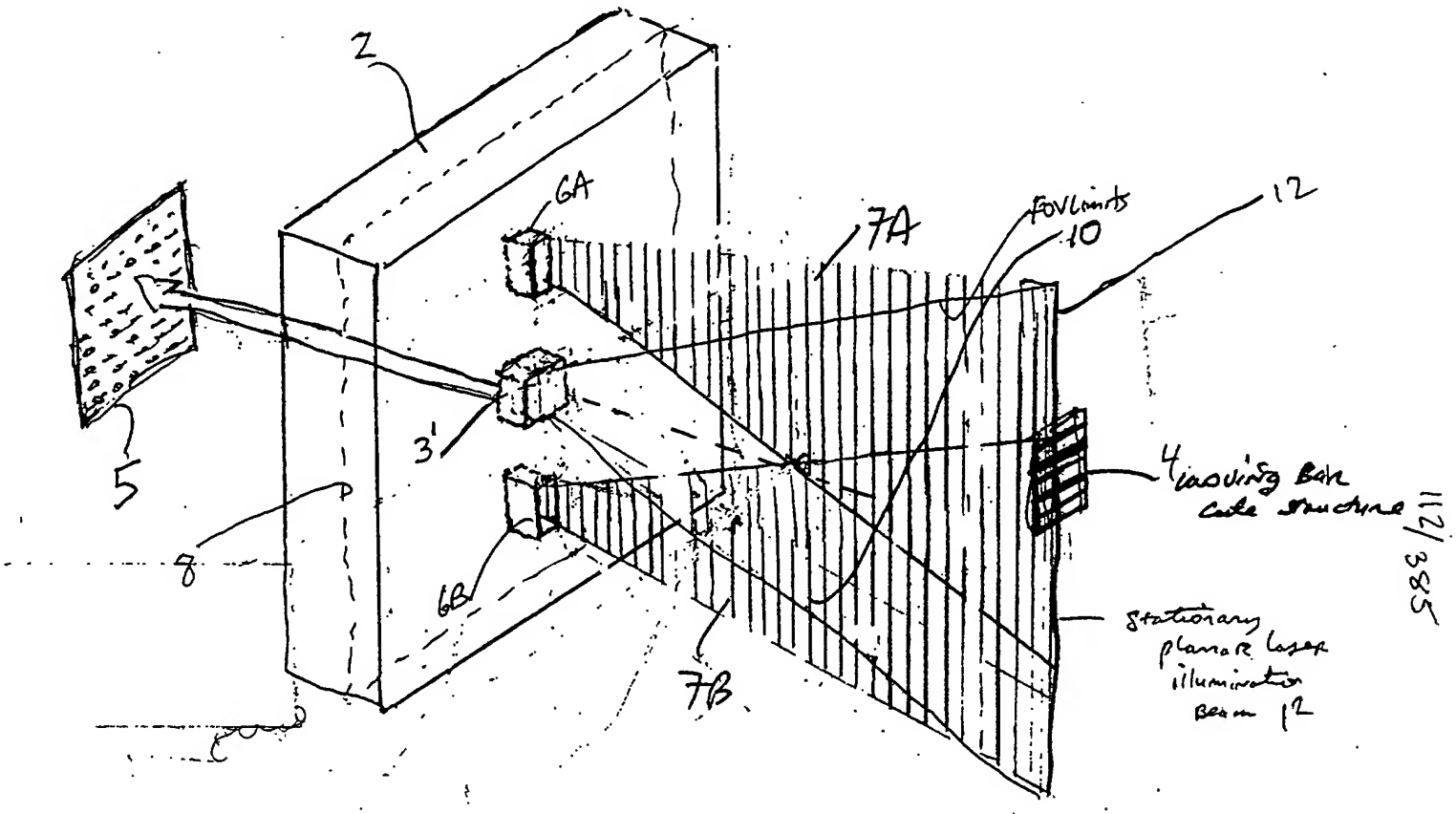


FIG. 2A

US 7,128,266 B2

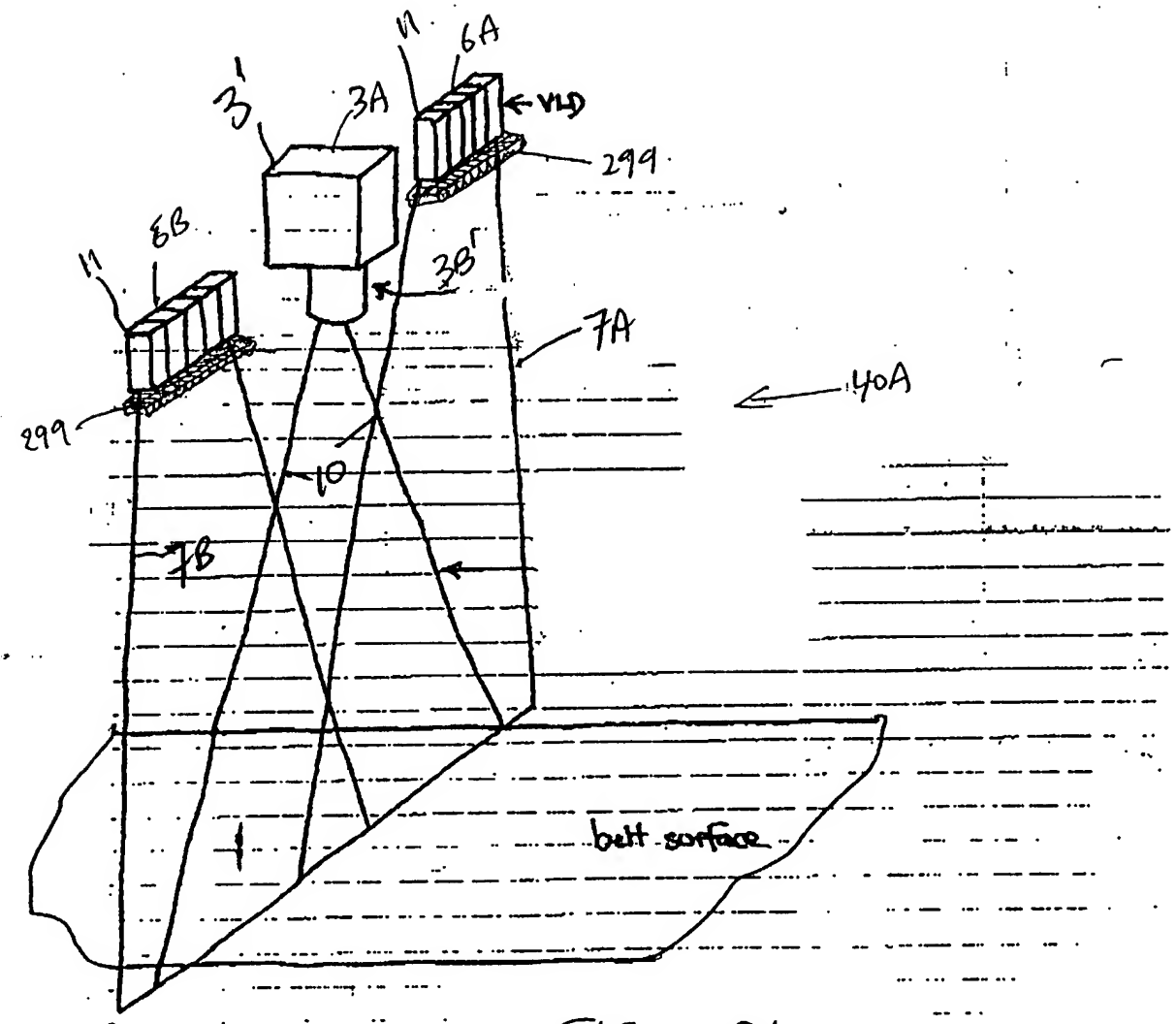


FIG. 2B1

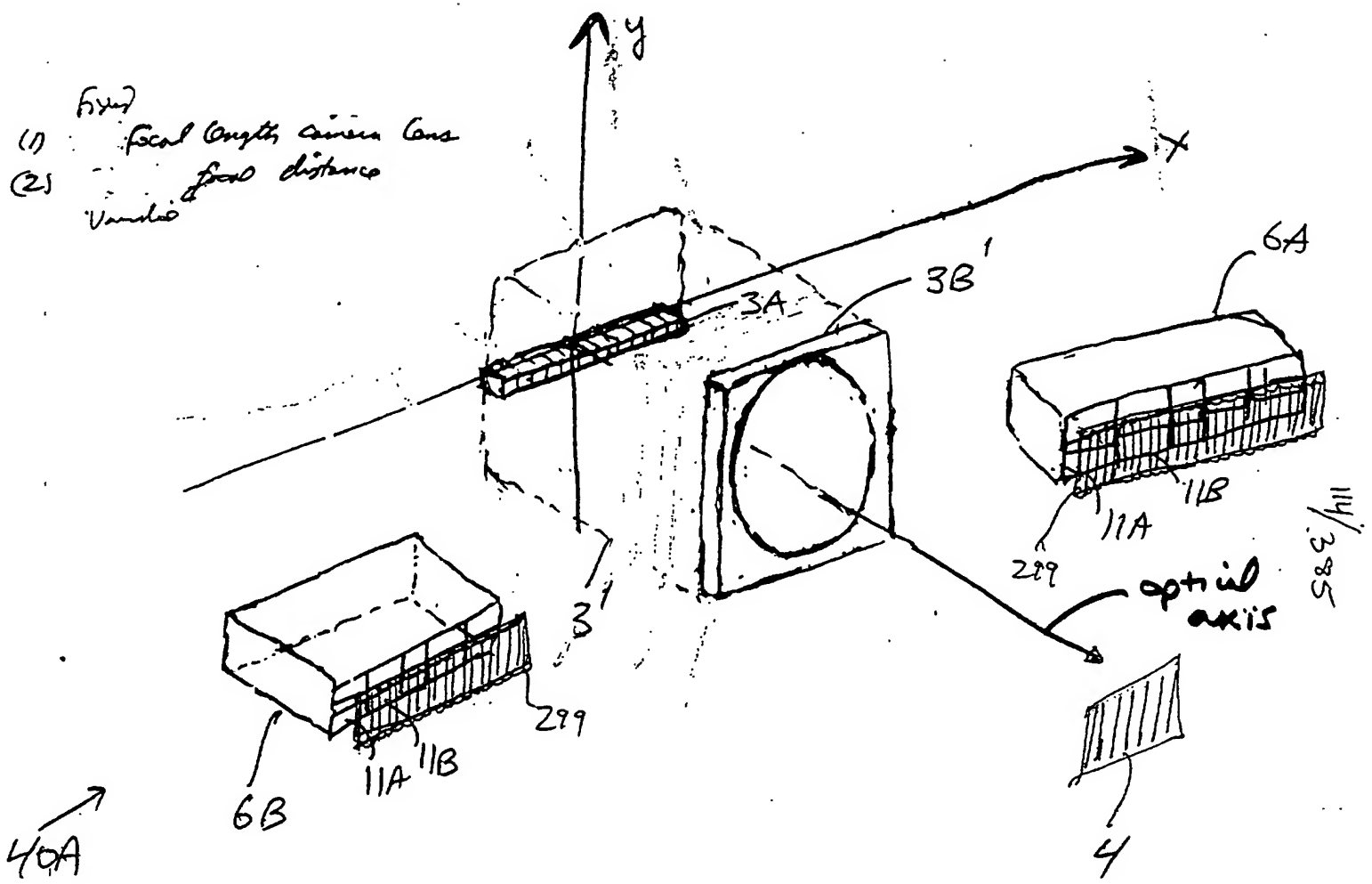


FIG 2B2

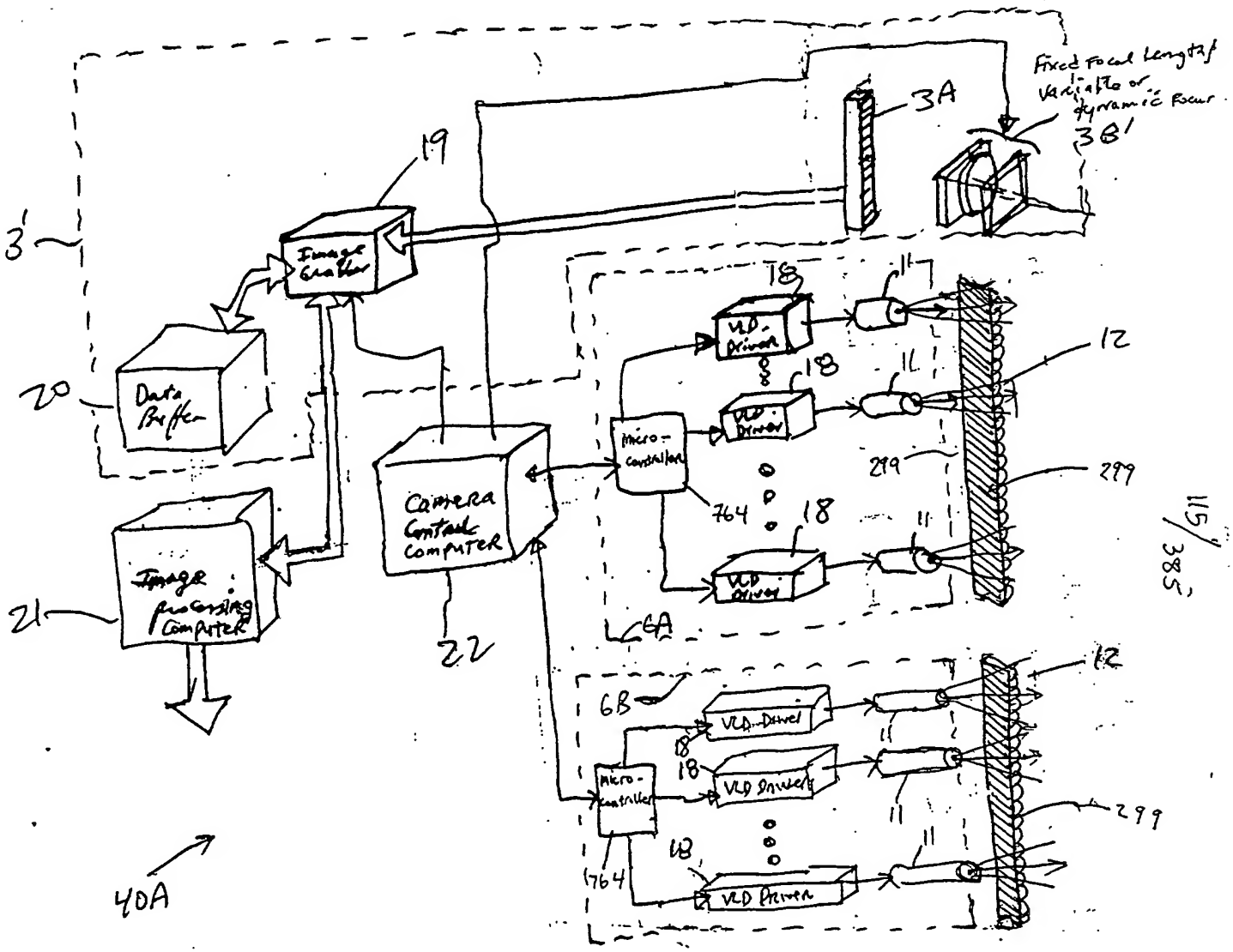

Fixed Focal Length or Variable or dynamic Focus
3A
3B'
19
3'
Image Grabber
20
Data Buffer
21
Image processing Computer
Camera Control Computer
22
18
11
VLD Driver
12
micro-controller
764
299
115/385
6A
6B
40A

FIG. 2C1

• fixed focal length imaging lens
• variable or dynamic focus control
3B'
3A'
3A
3D
3C
3'
3E
22

FIG. 26Z

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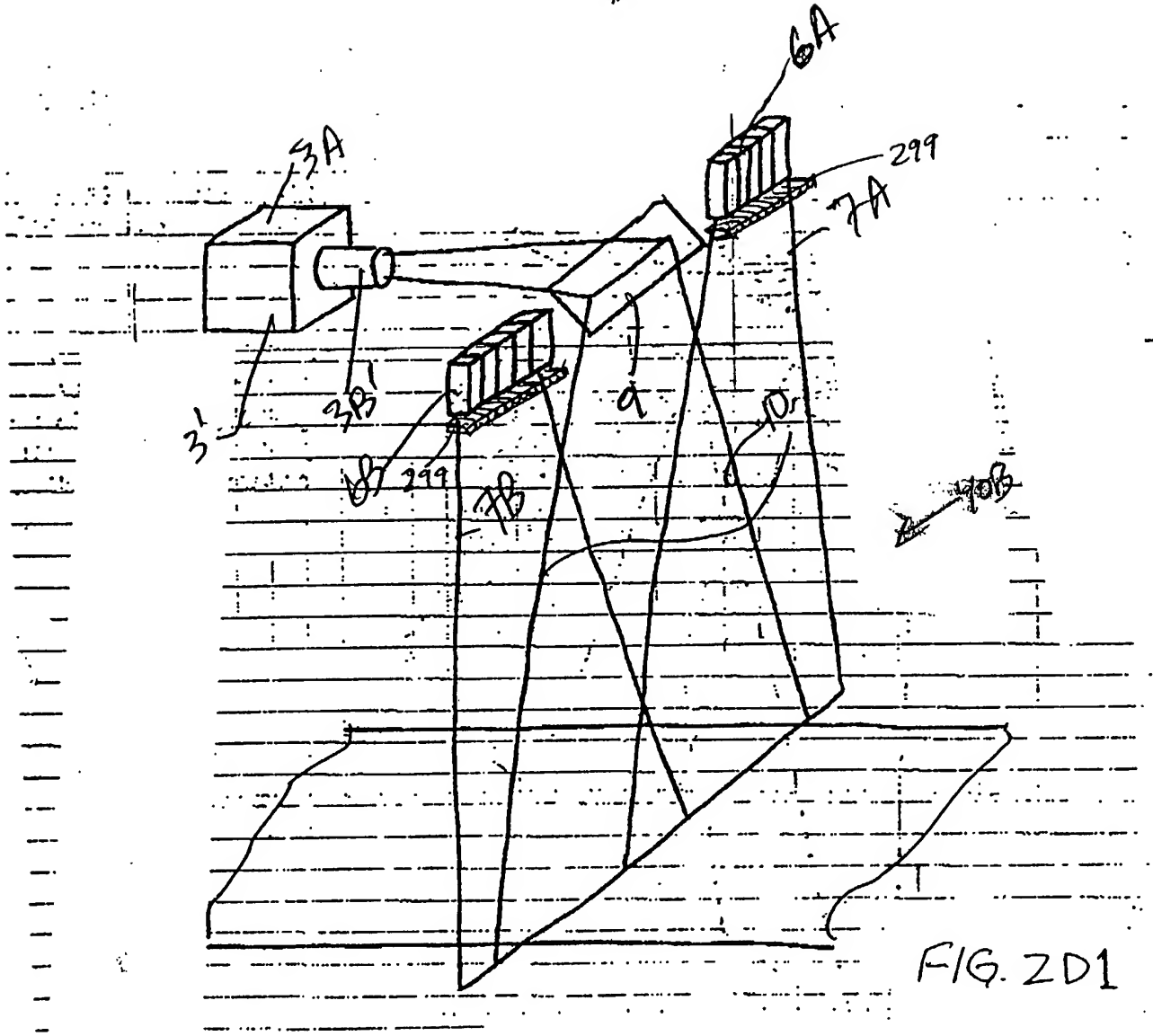

FIG. 2D1

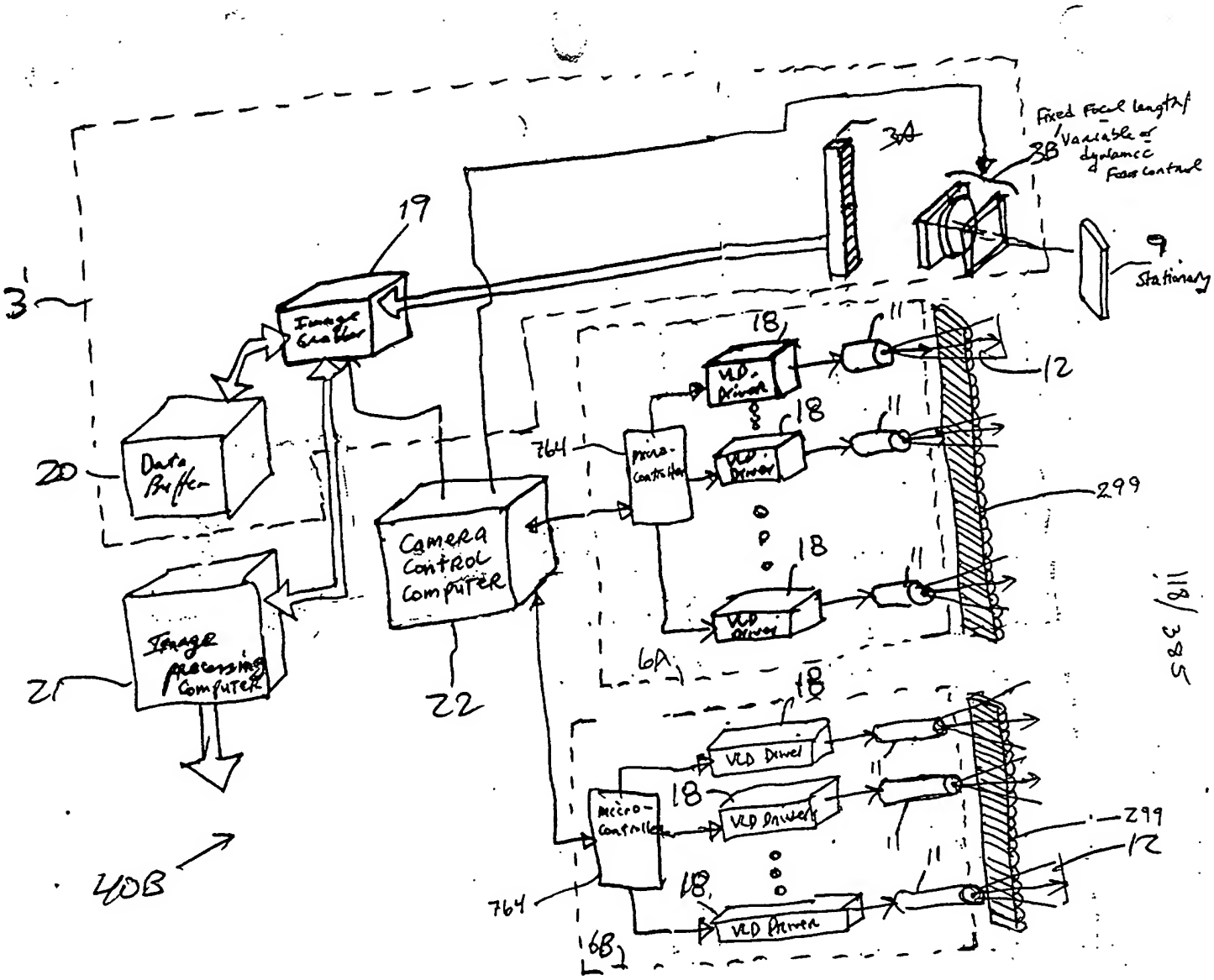
Fixed Focal length
Variable or dynamic Focus control
3A
3B
19
9
Stationary
3
Image Grabber
18
VLD Driver
12
764
micro-controller
20
Data Buffer
299
Camera Control Computer
21
Image processing Computer
22
6A
6B
Micro-Controller
408

FIG. 2D2

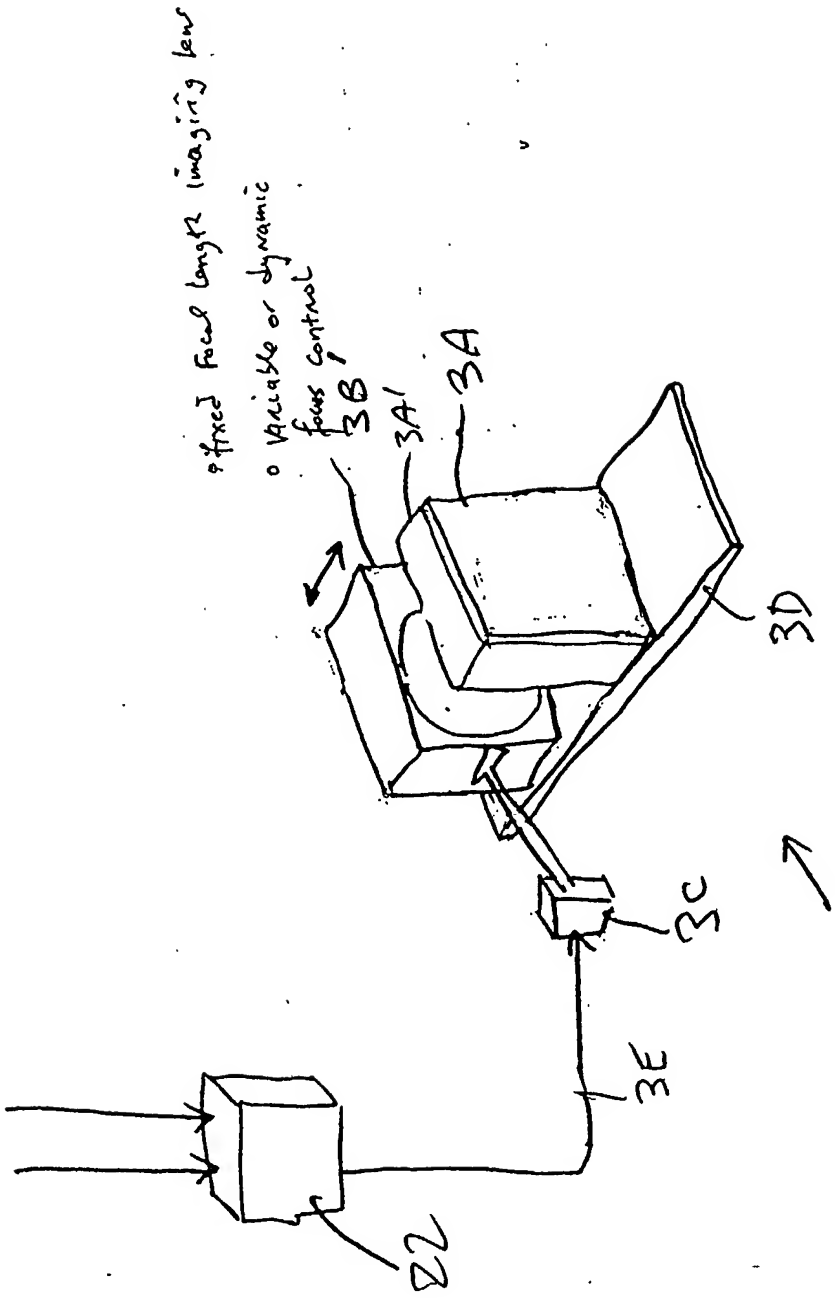
o fixed focal length imaging lens
o variable or dynamic focus control
3B'
3A'
3A
3D
3C
3'
3E
22

FIG. 2D3

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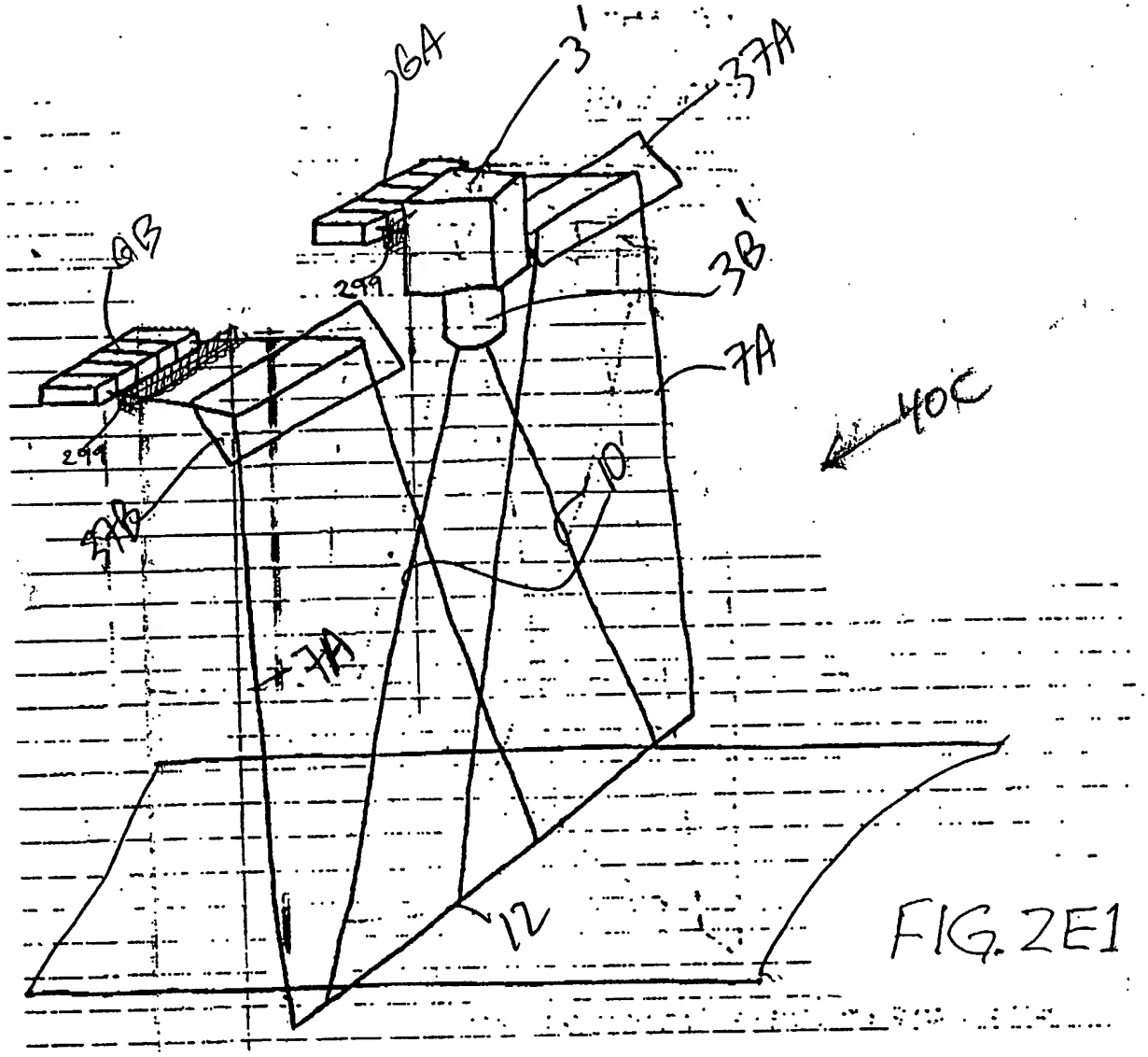

FIG. 2E1

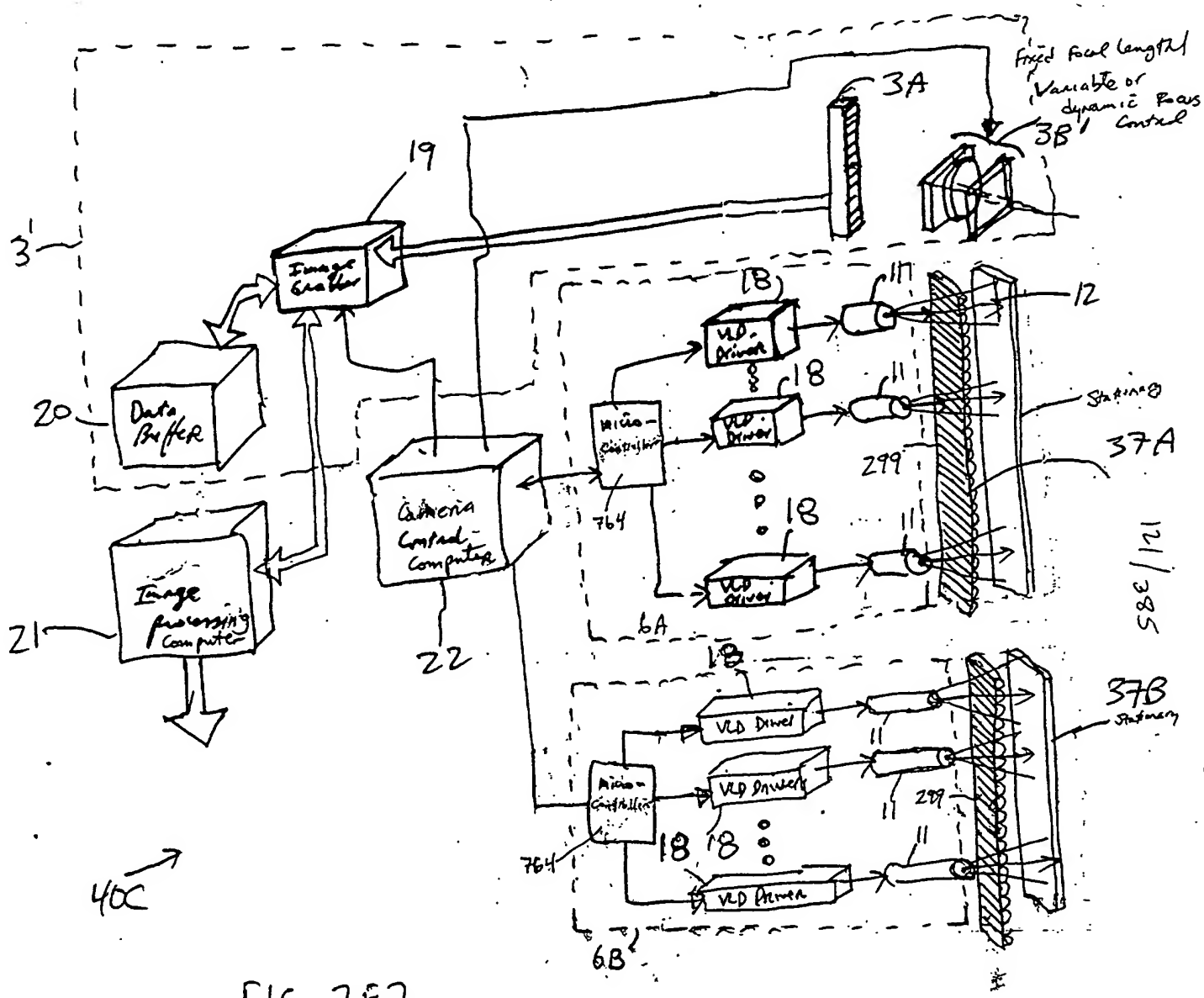
Fixed focal length/
Variable or
dynamic Focus
Control
3A
3B
19
3'
Image Grabber
20
Data Buffer
Camera Control Computer
Image processing Computer
21
22
764
18
299
37A
37B
6A
6B
40C

FIG. 2E2

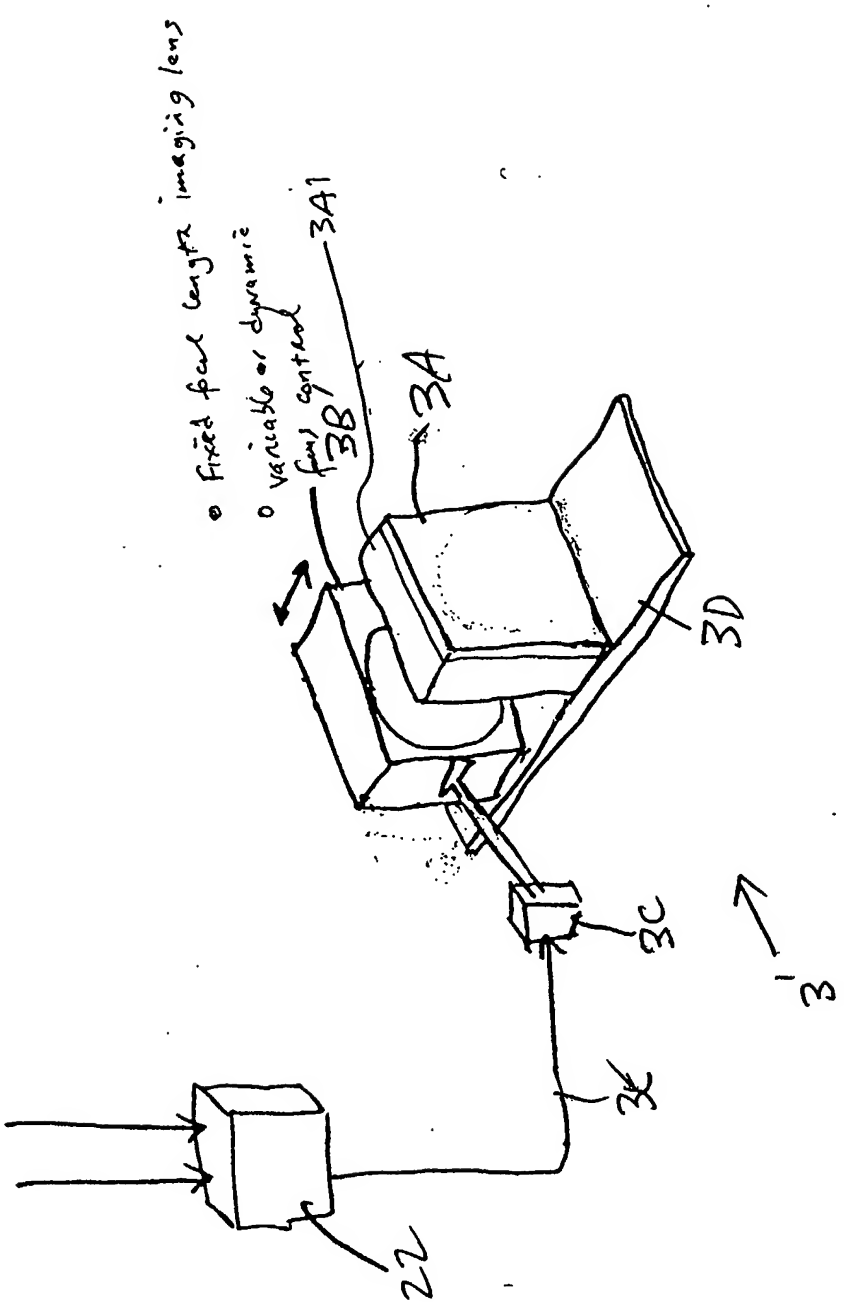
• Fixed focal length imaging lens
○ variable or dynamic focus control
3B
3A1
3A
3D
3C
3
3E
22

FIG. 2E3

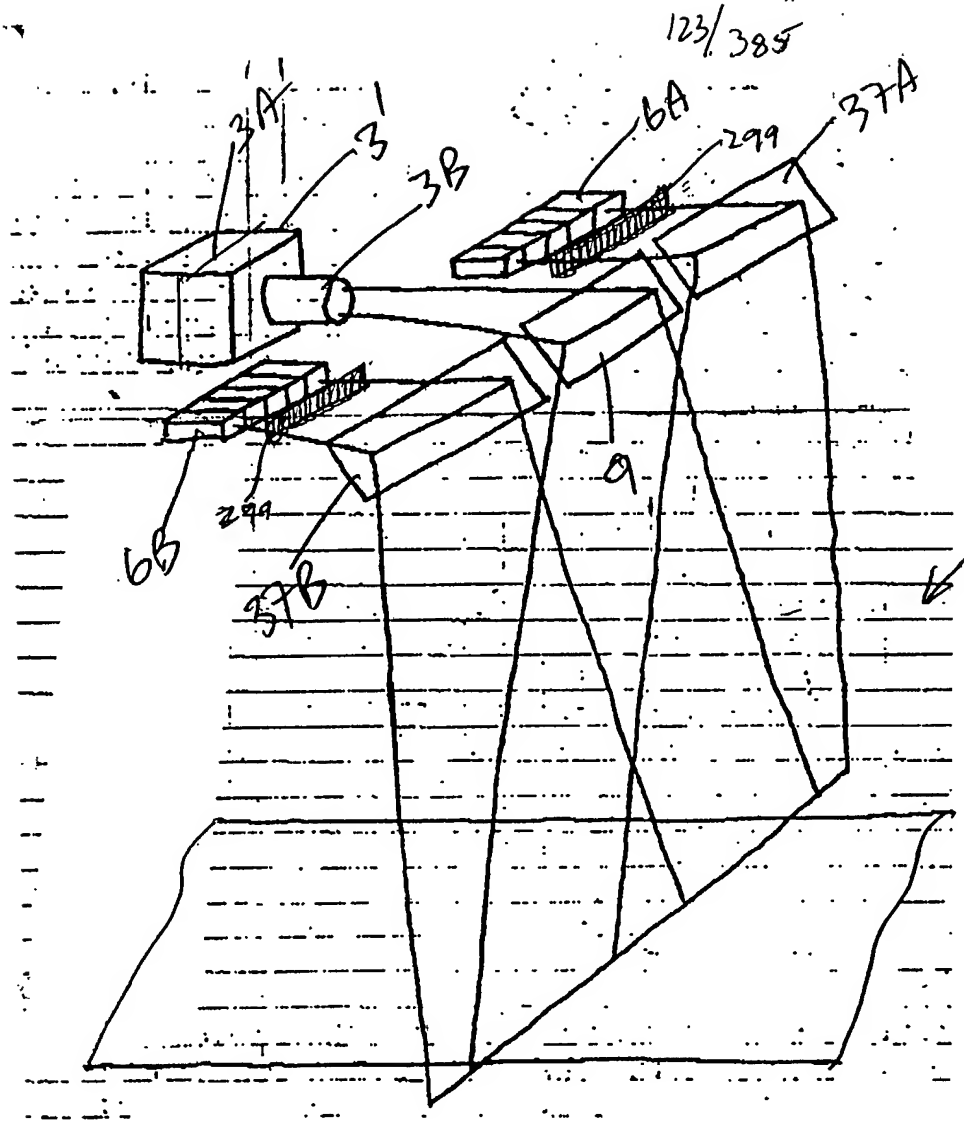

FIG. 2F1

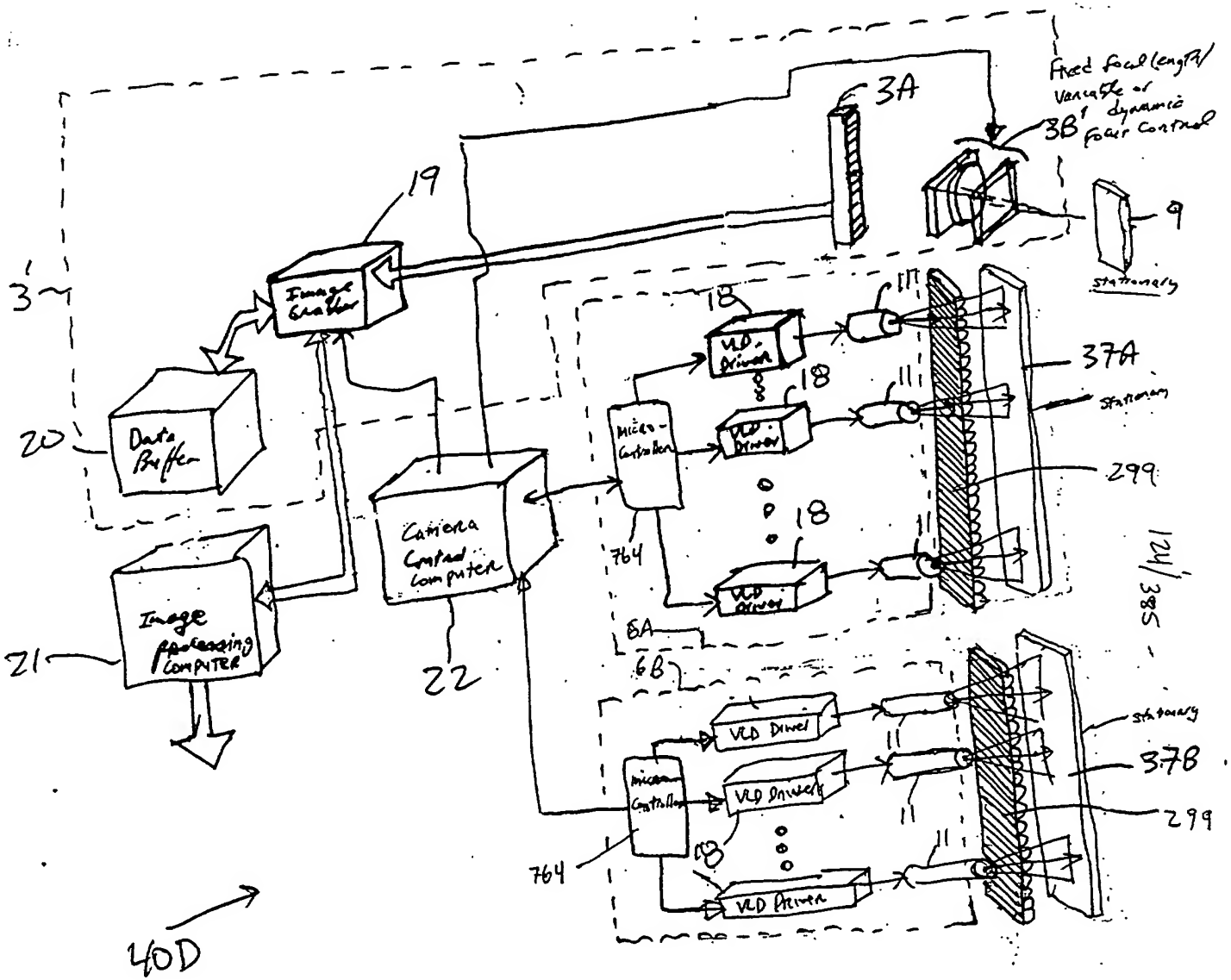
Fixed focal length/
Variable or
dynamic
Focus Control
3A
3B'
19
9
Stationary
3'
18
VLD Driver
37A
20
Data Buffer
Camera Control Computer
Image Processing Computer
21
22
764
299
121'
385
8A
6B
37B
40D

FIG 2F2

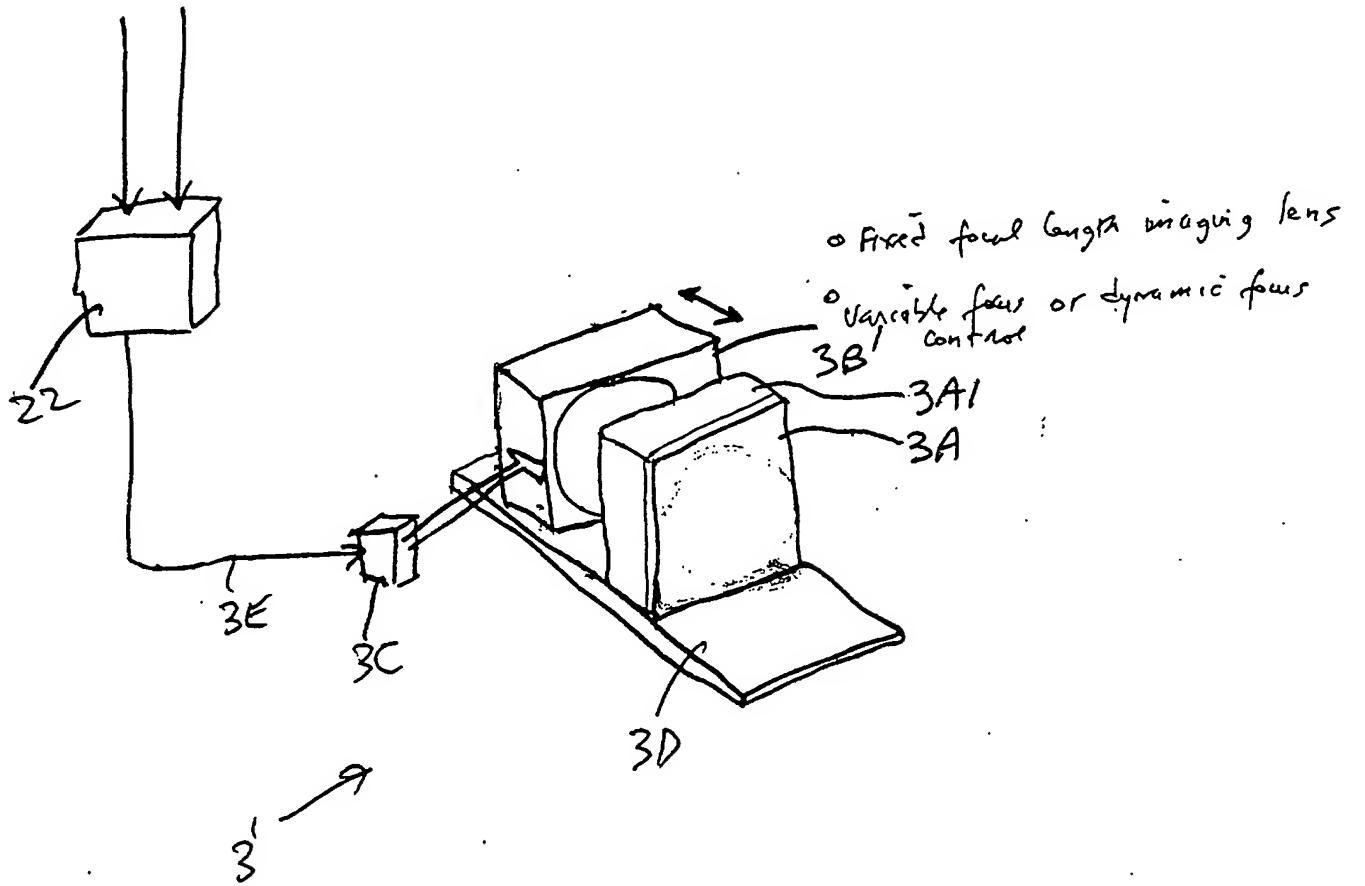

FIG. 2F3

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20220220.2288400.1E

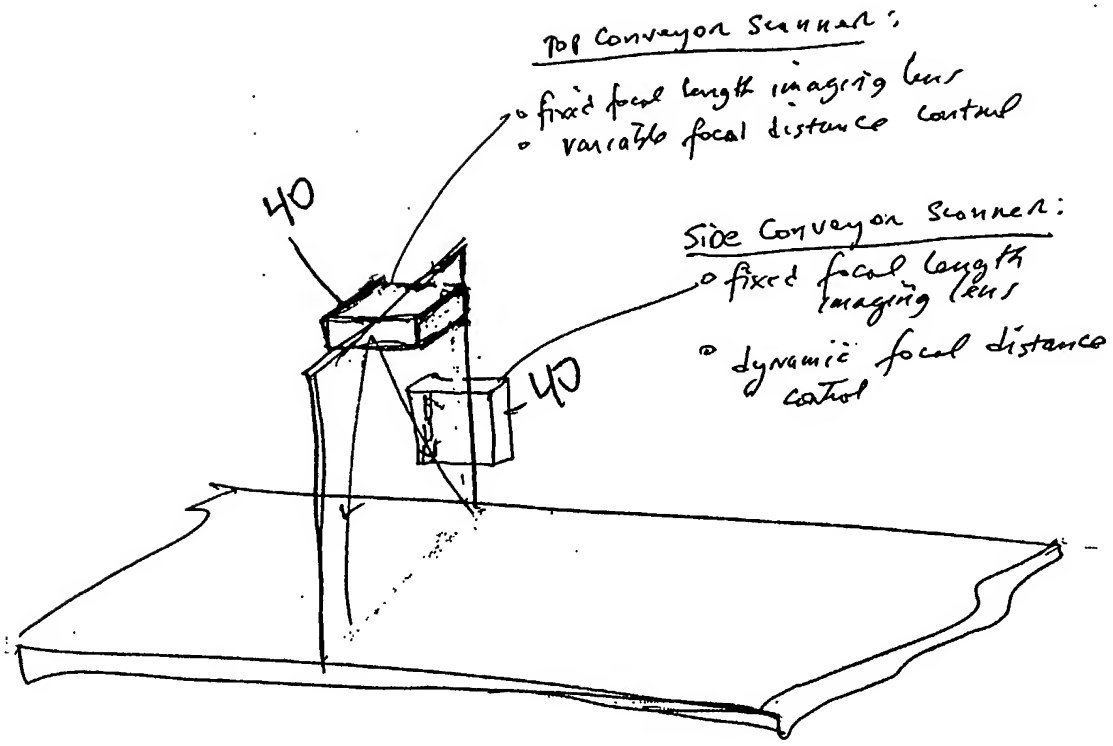

Top Conveyor Scanner:
o fixed focal length imaging lens
o variable focal distance control
40
Side Conveyor Scanner:
o fixed focal length imaging lens
o dynamic focal distance control
40

FIG. 2G

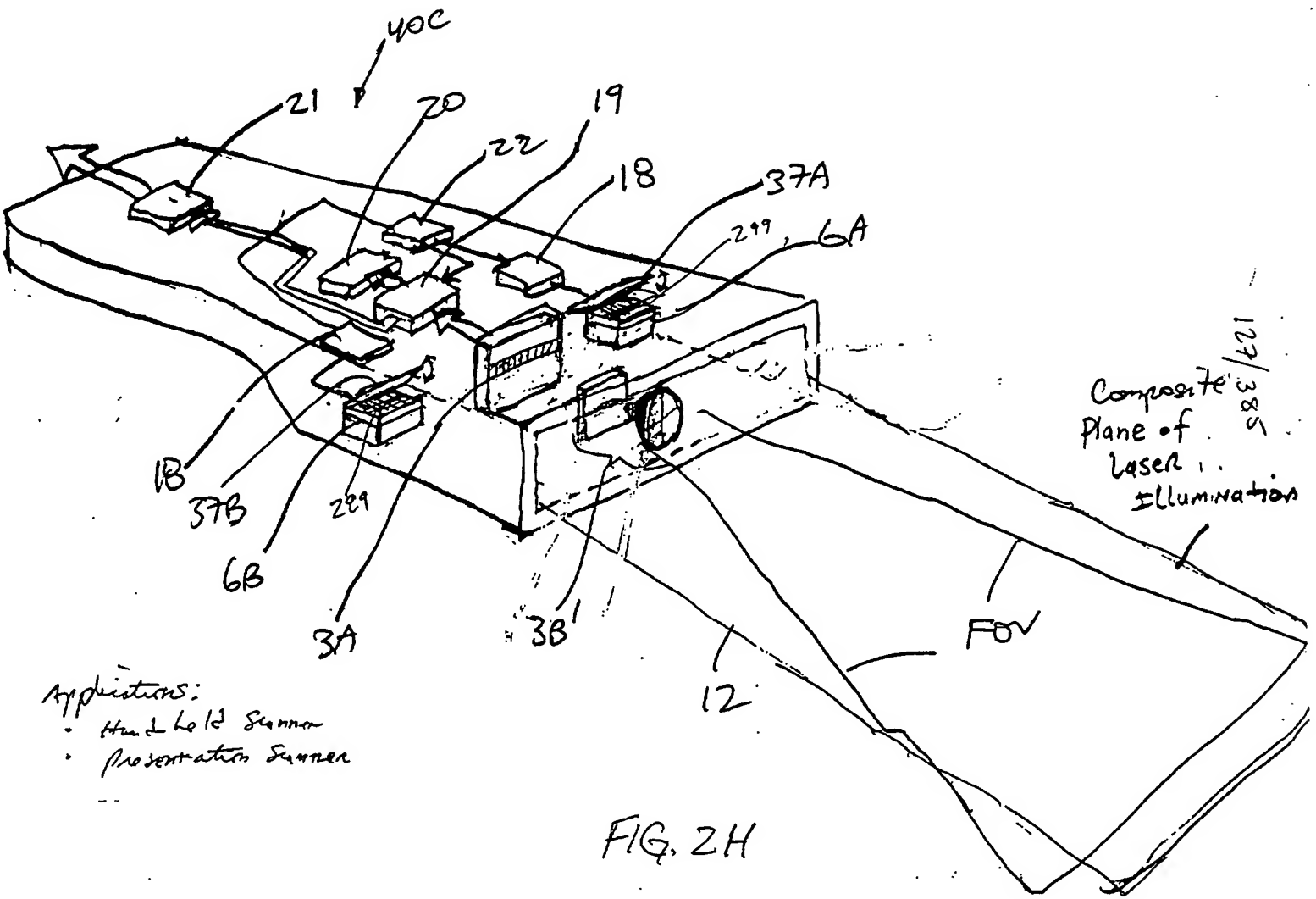

40C
21
20
22
19
18
37A
29
6A
1B
37B
29
6B
3A
3B'
12
Composite Plane of Laser Illumination
FOV
127/385
Applications:
• Hand-held Scanner
• Presentation Scanner

FIG. 2H

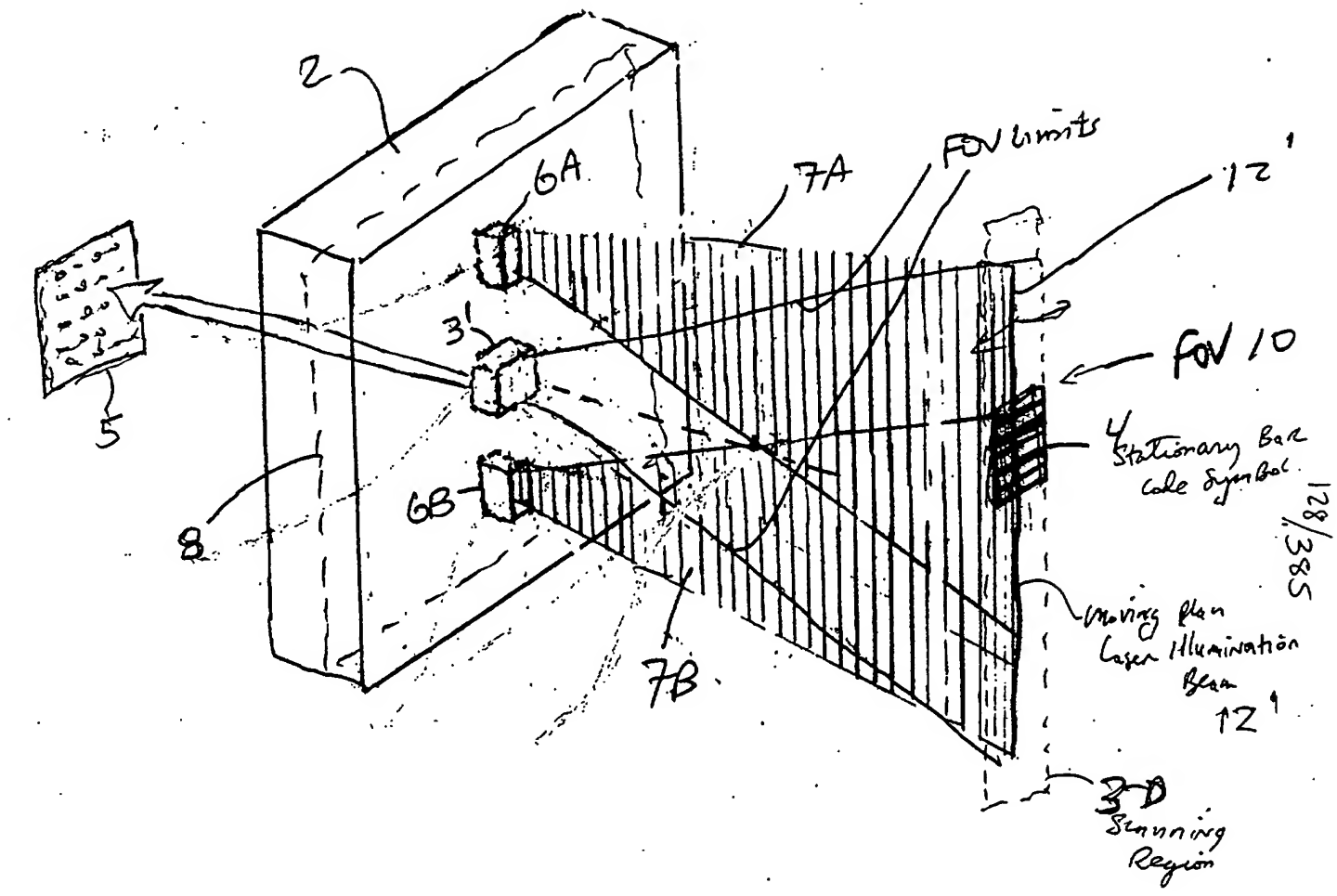


FIG. 2I1

128/385

US006340227 - 020202

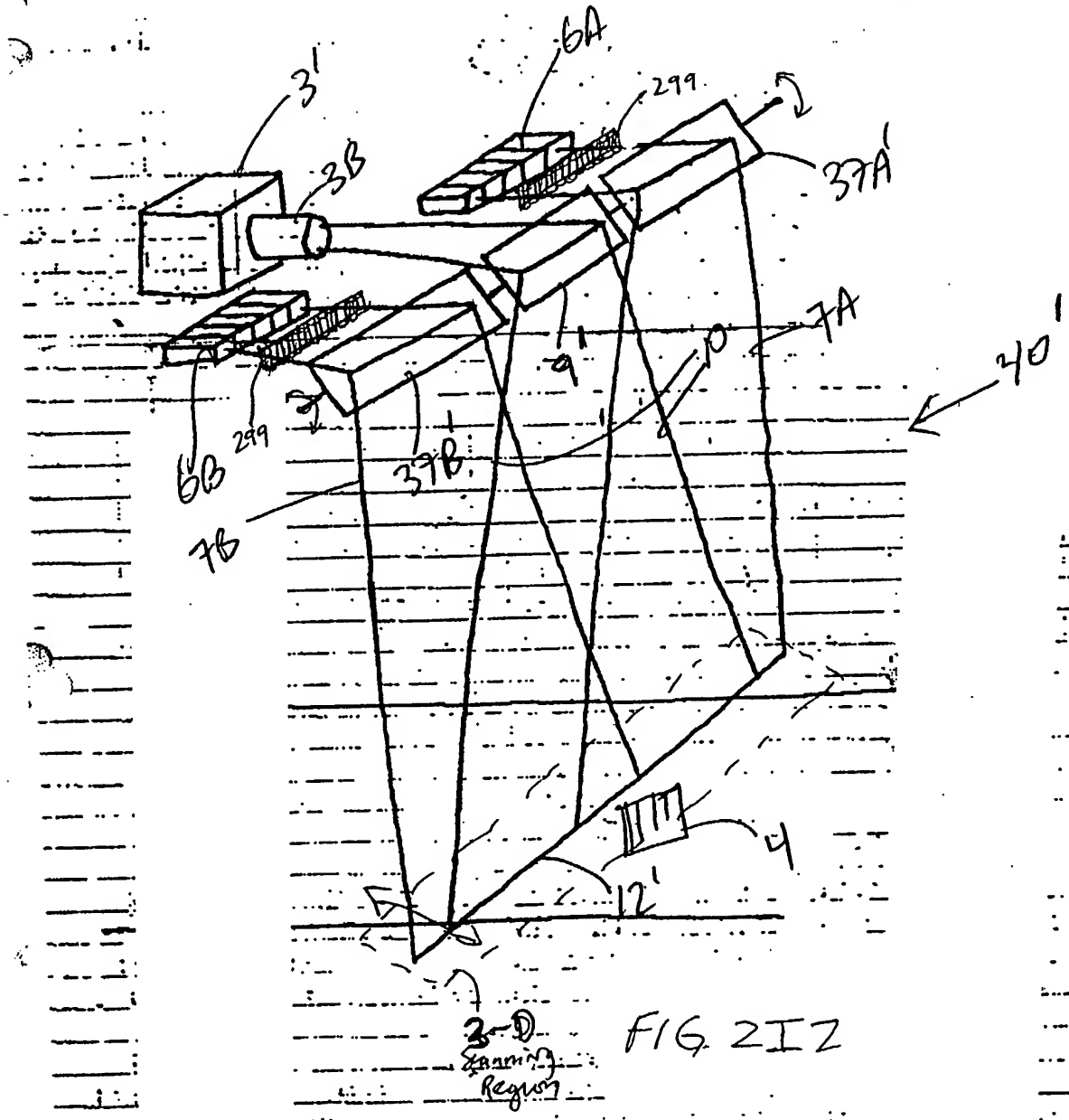


FIG. 2I2

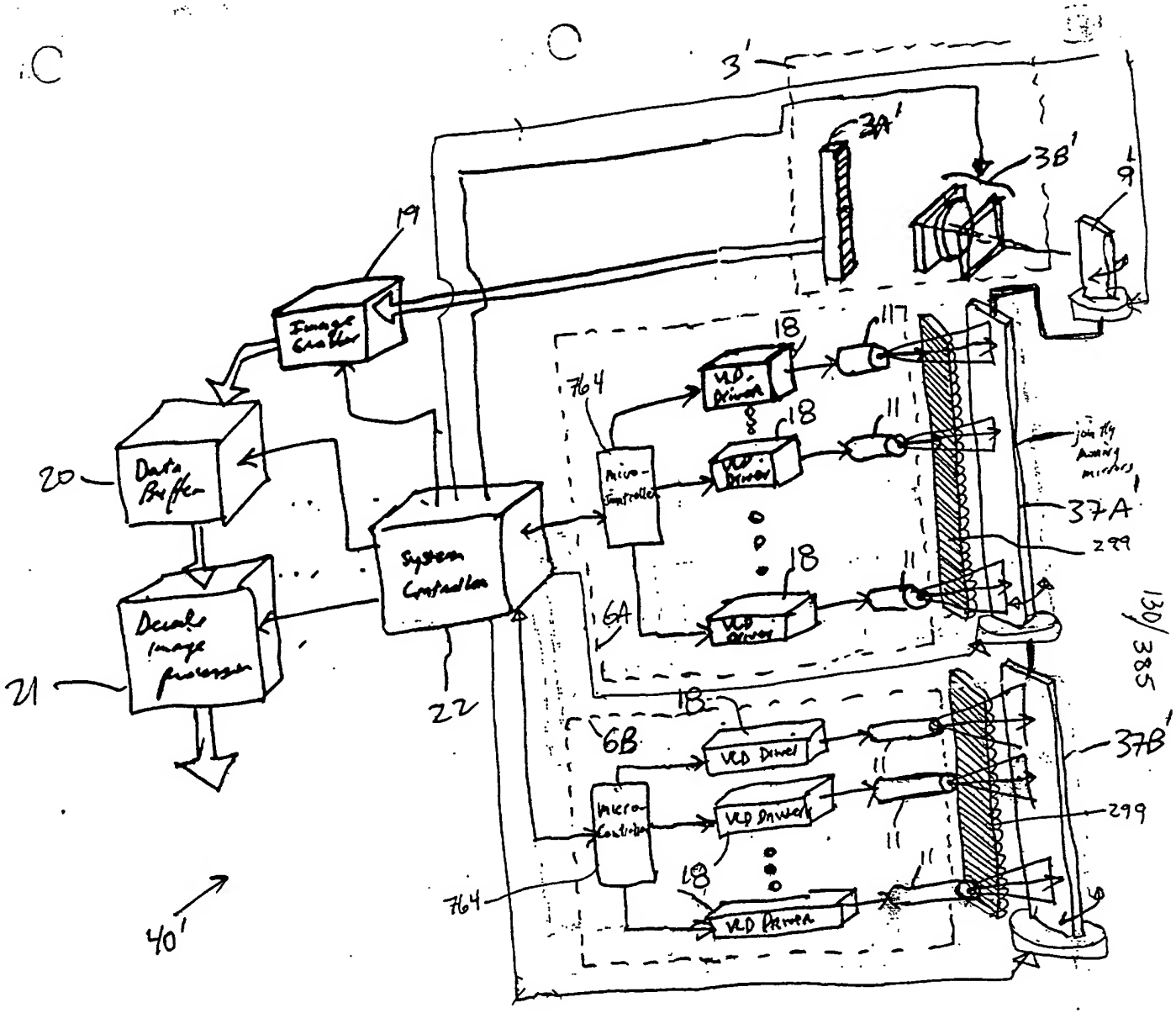

3'
3A'
3B'
9'
19
Image Controller
20
Data Buffer
21
Decode Image Processor
22
System Controller
18
VLD Driver
764
Micro-Controller
117
37A
299
130/385
6A
6B
37B'
40'

FIG. 2I3

• fixed focal length imaging lens
• variable or dynamic focus control
3B'
3A
3A'
3D
3
3C
3E
22

FIG. 2I4

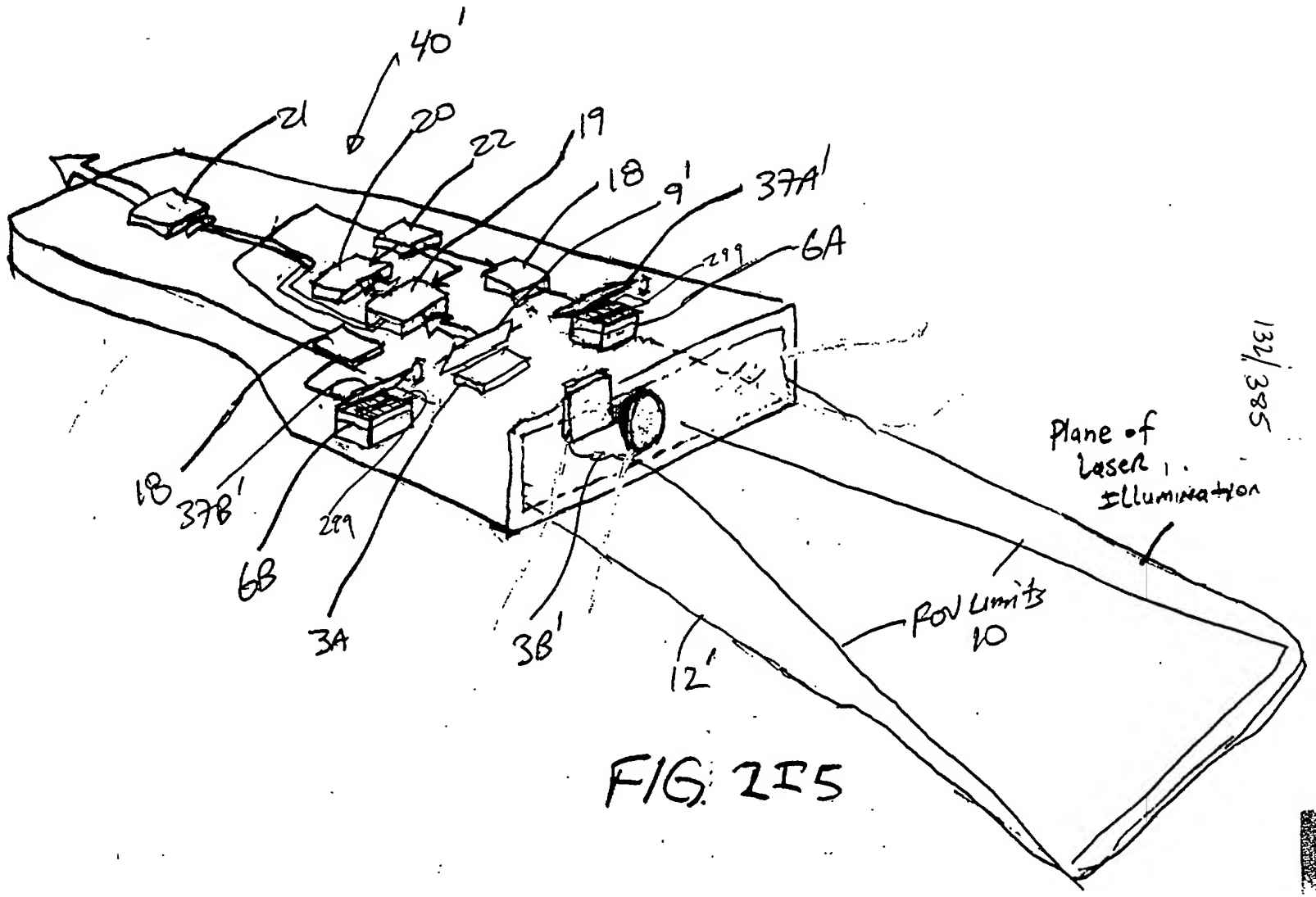

40'
21
20
22
19
18
9'
37A'
6A
299
132/385
Plane of Laser Illumination
18
37B'
299
6B
3A
3B'
12'
FOV Limits
10

FIG. 2I5

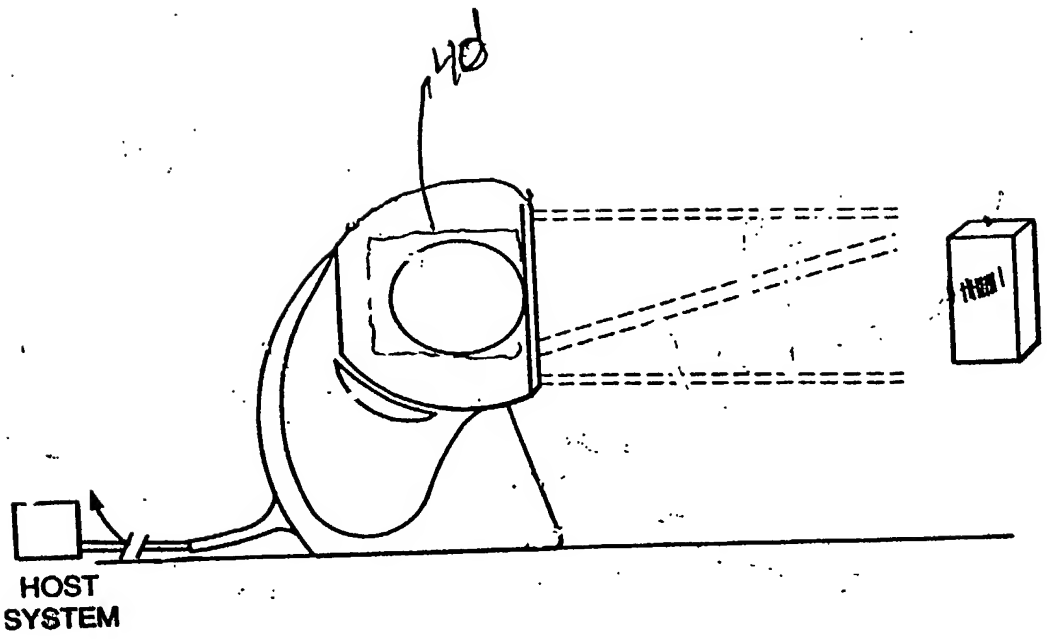


FIG. 2I6

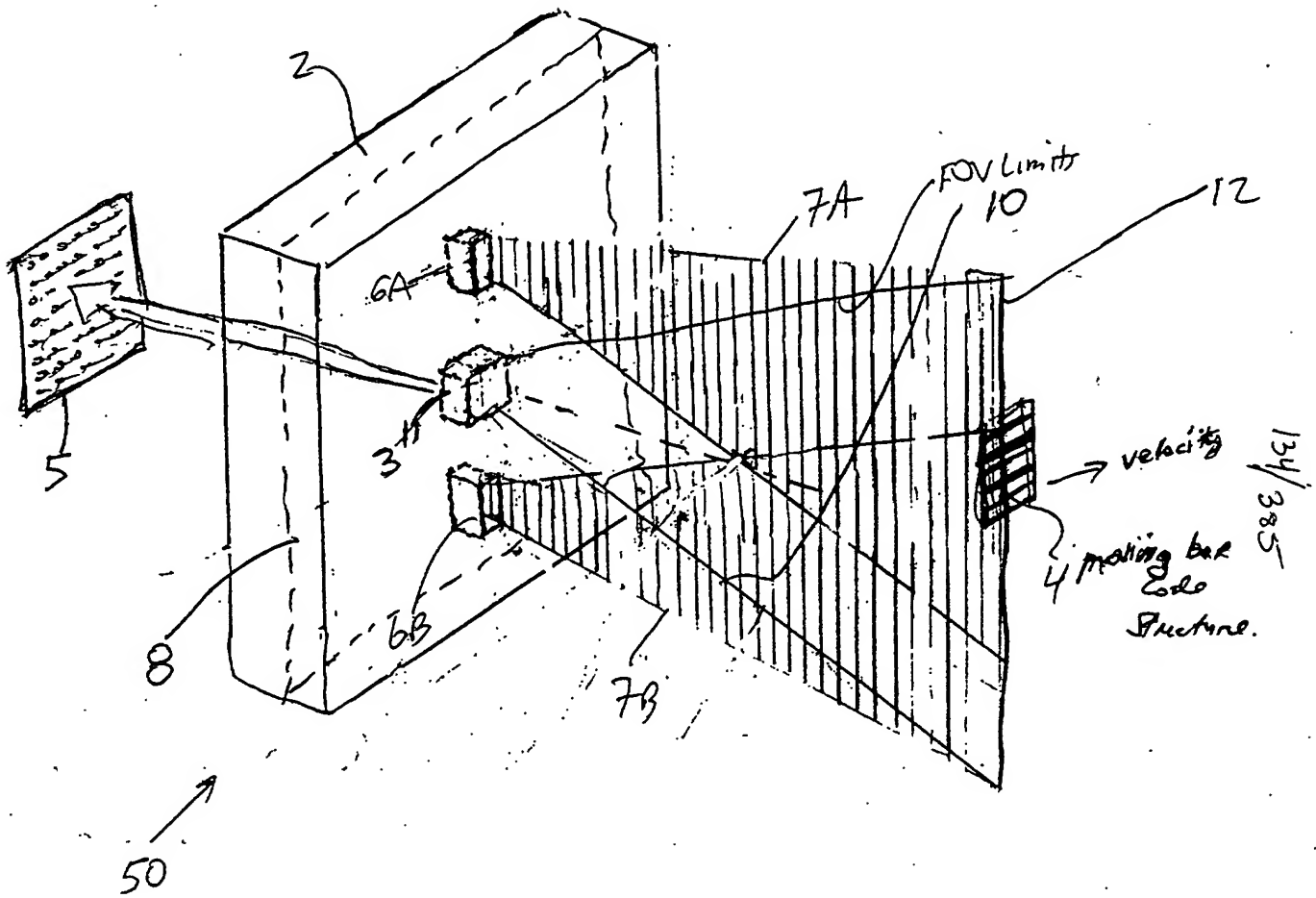


FIG 3A

20220228.0220.2022007

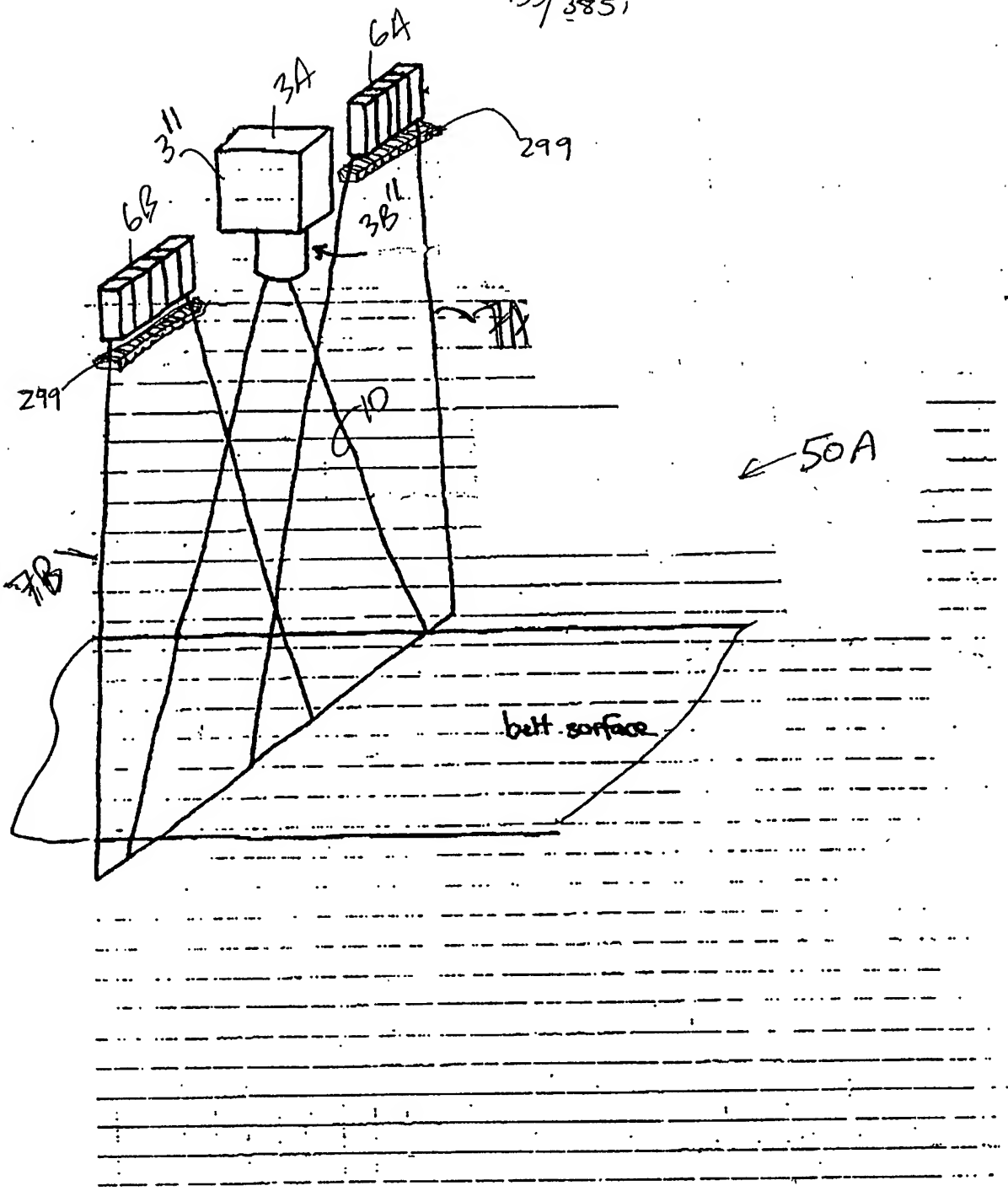


FIG. 3B1

(1) Variable Focal Length camera Lens
(2) variable focal distance

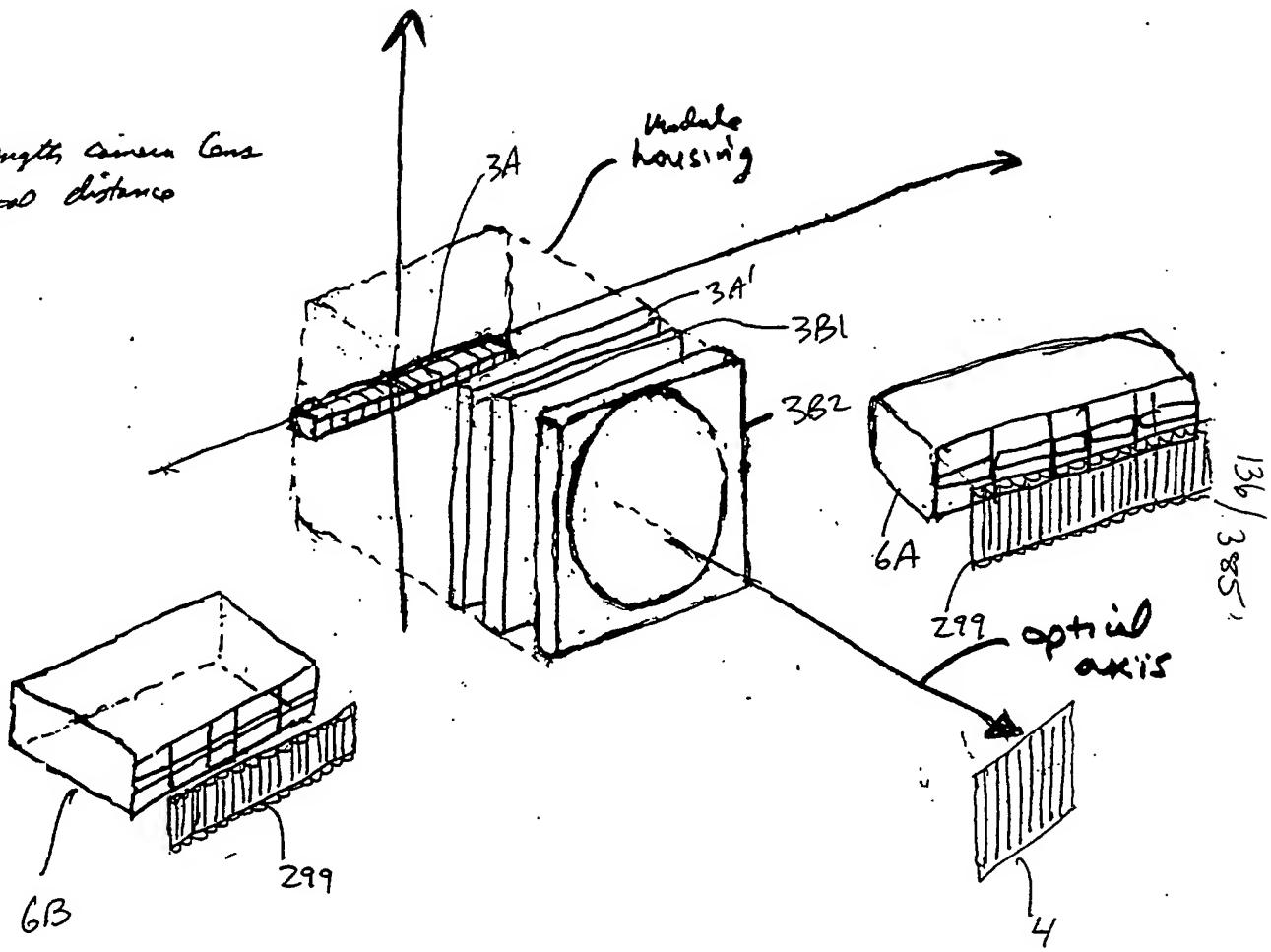


FIG. 3B2

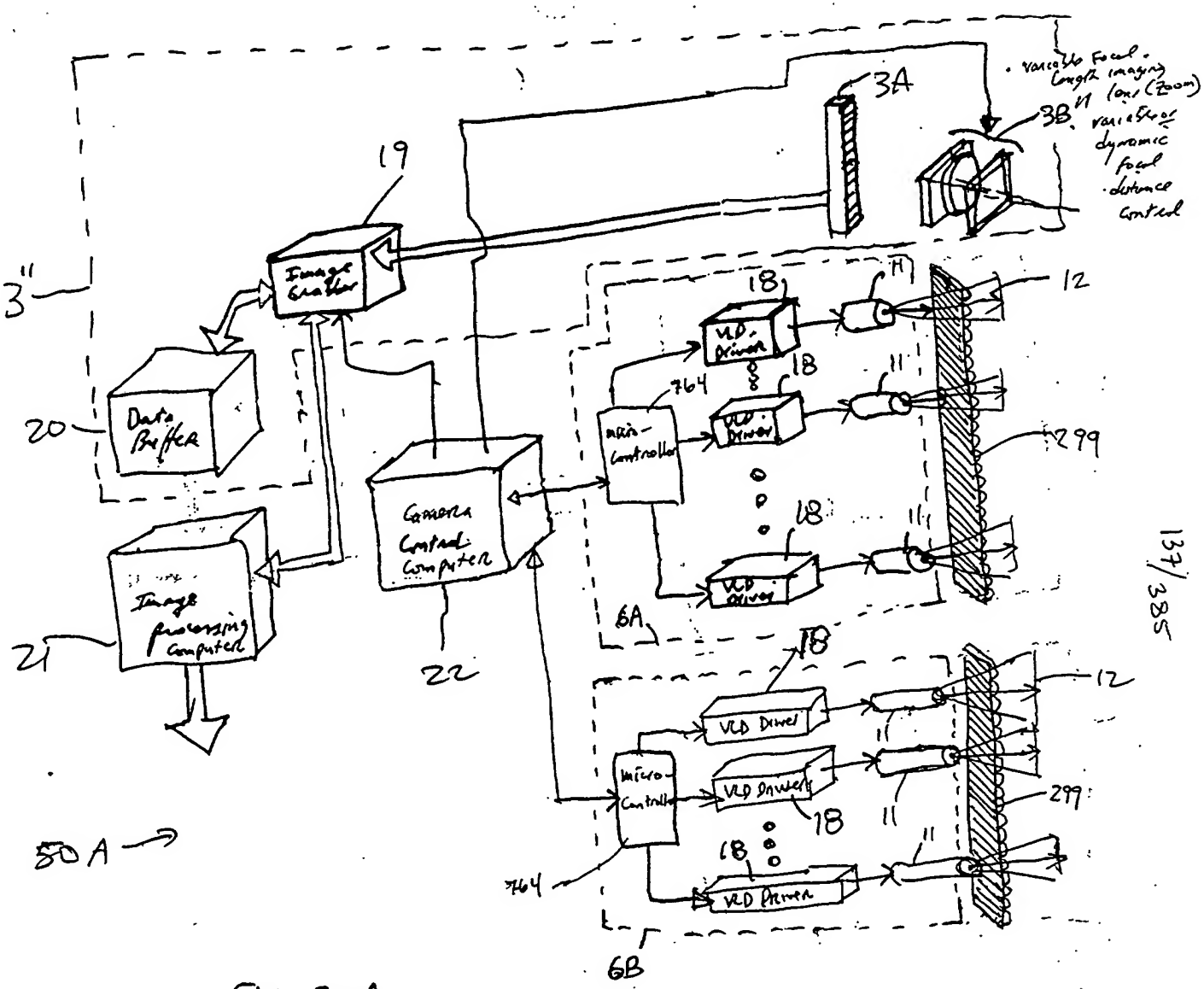
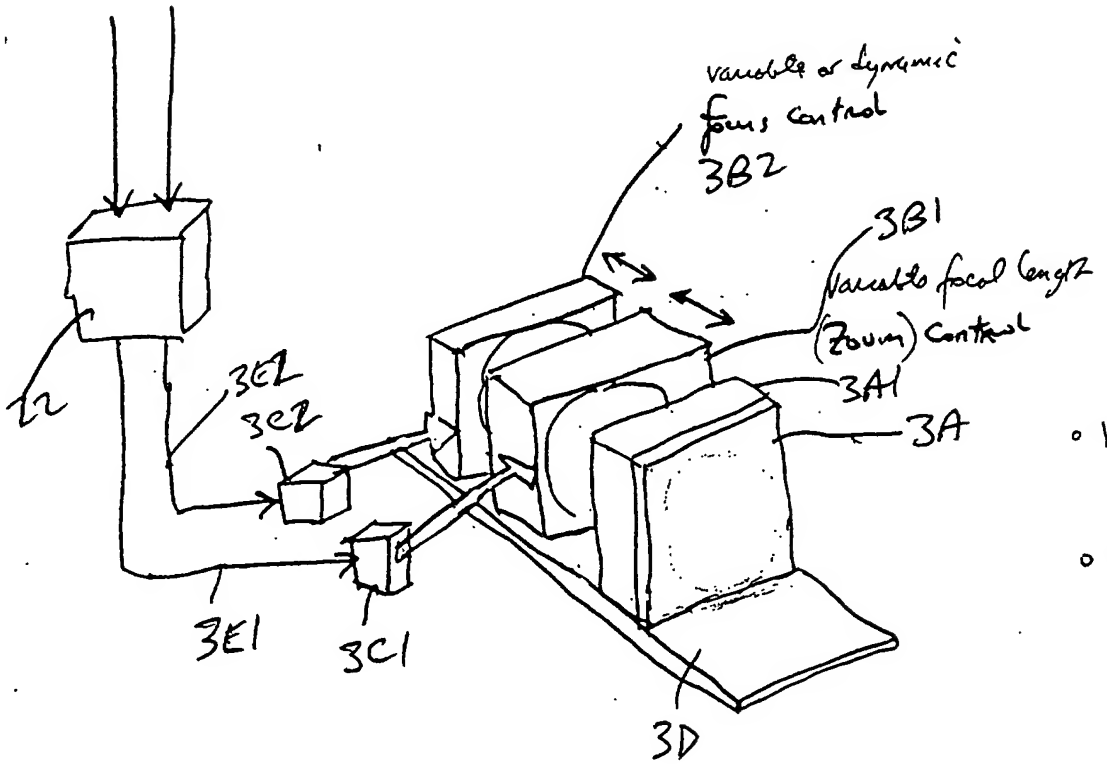

3A
3B
variable focal length imaging lens (zoom)
variable dynamic focal distance control
19
3"
Image Grabber
20
Data Buffer
21
Image processing Computer
Camera Control Computer
22
18
VLD driver
764
main-controller
micro-controller
12
299
137/385
6A
6B
50A

FIG 3C1



- variable focal length camera lens 138/385
- variable focal distance

FIG. 3C2

20220220 "22884800"

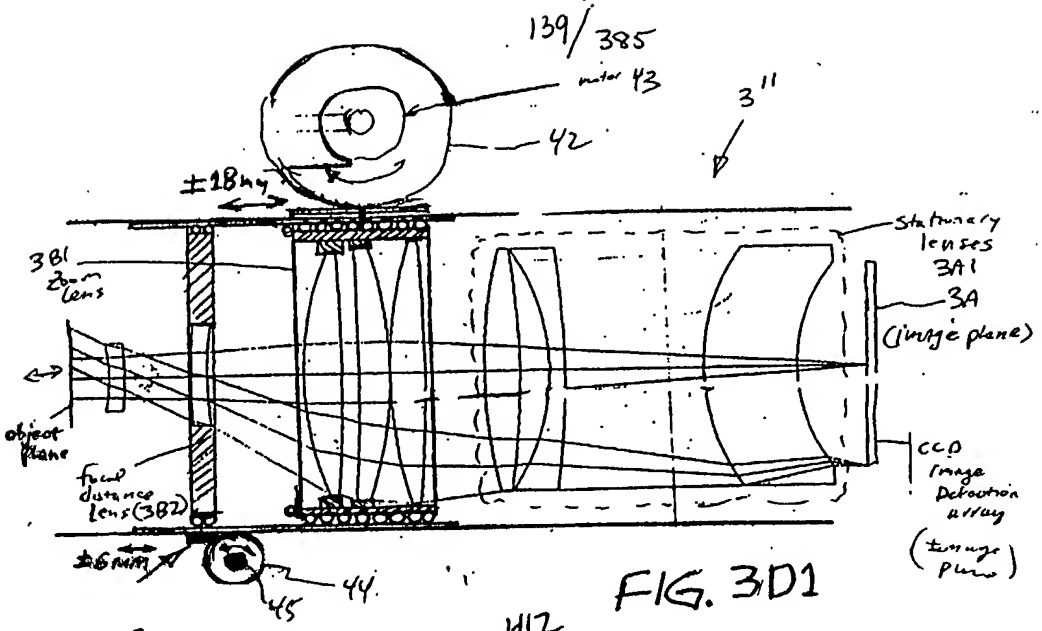


FIG. 3D1

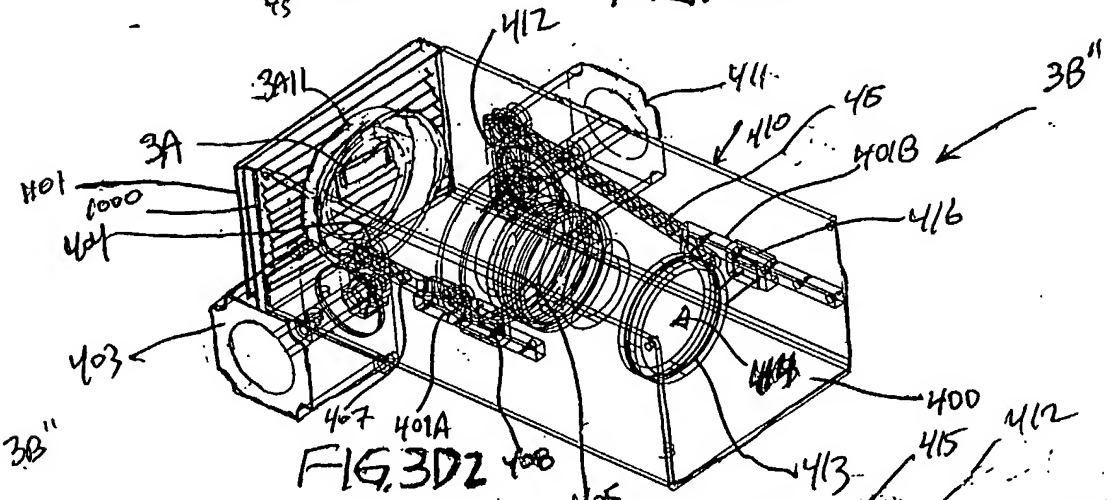


FIG. 3D2

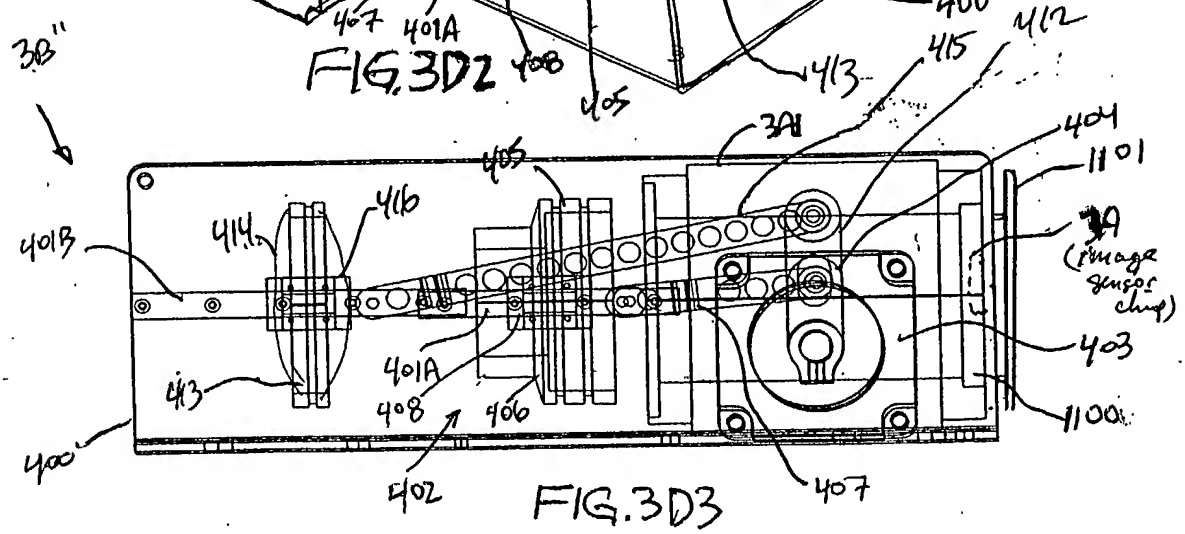


FIG. 3D3

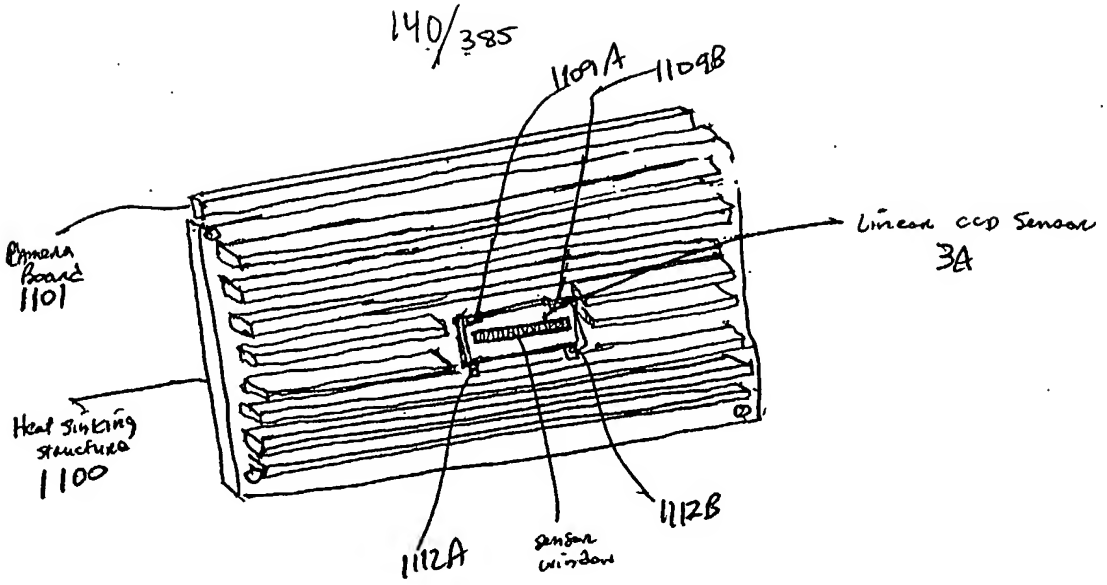


FIG. 3D4

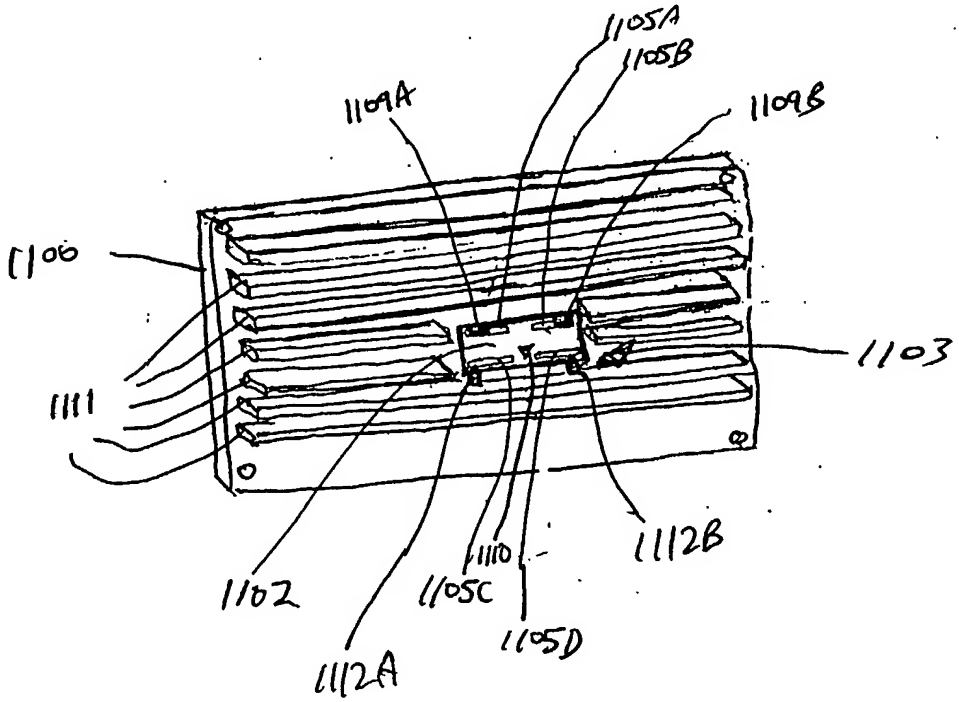


FIG. 3D5

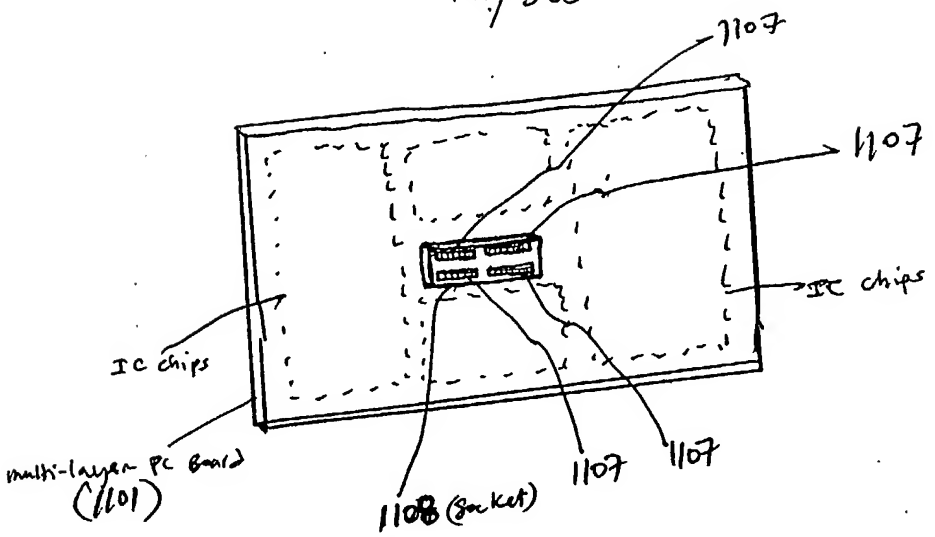


FIG. 3D6

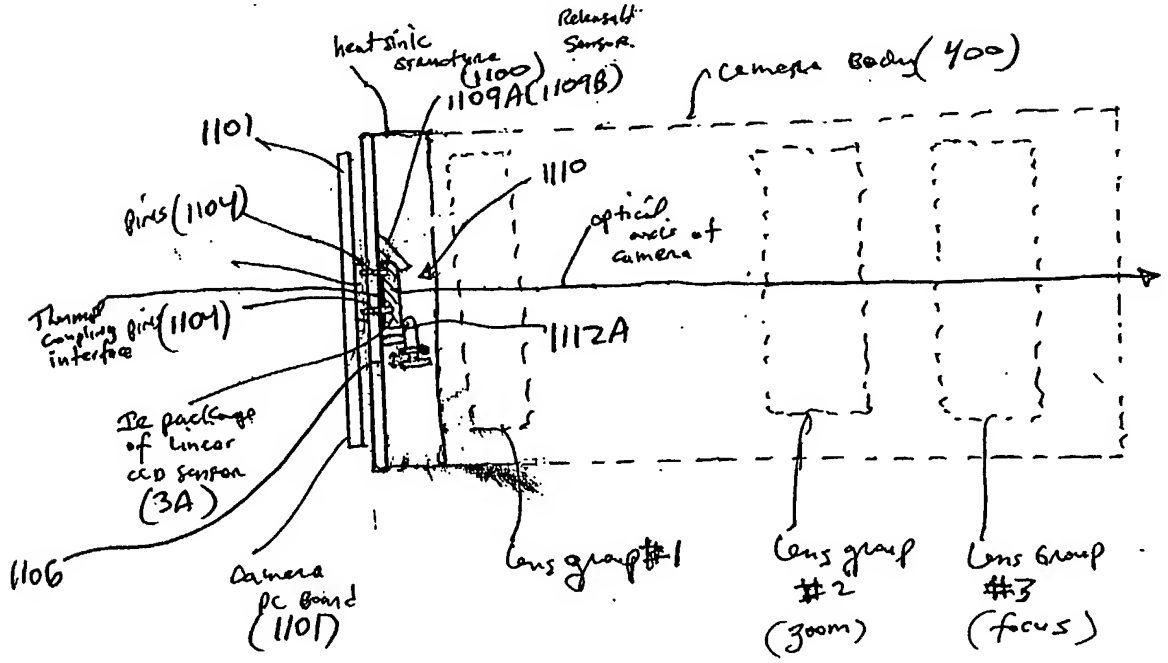


FIG. 3D7

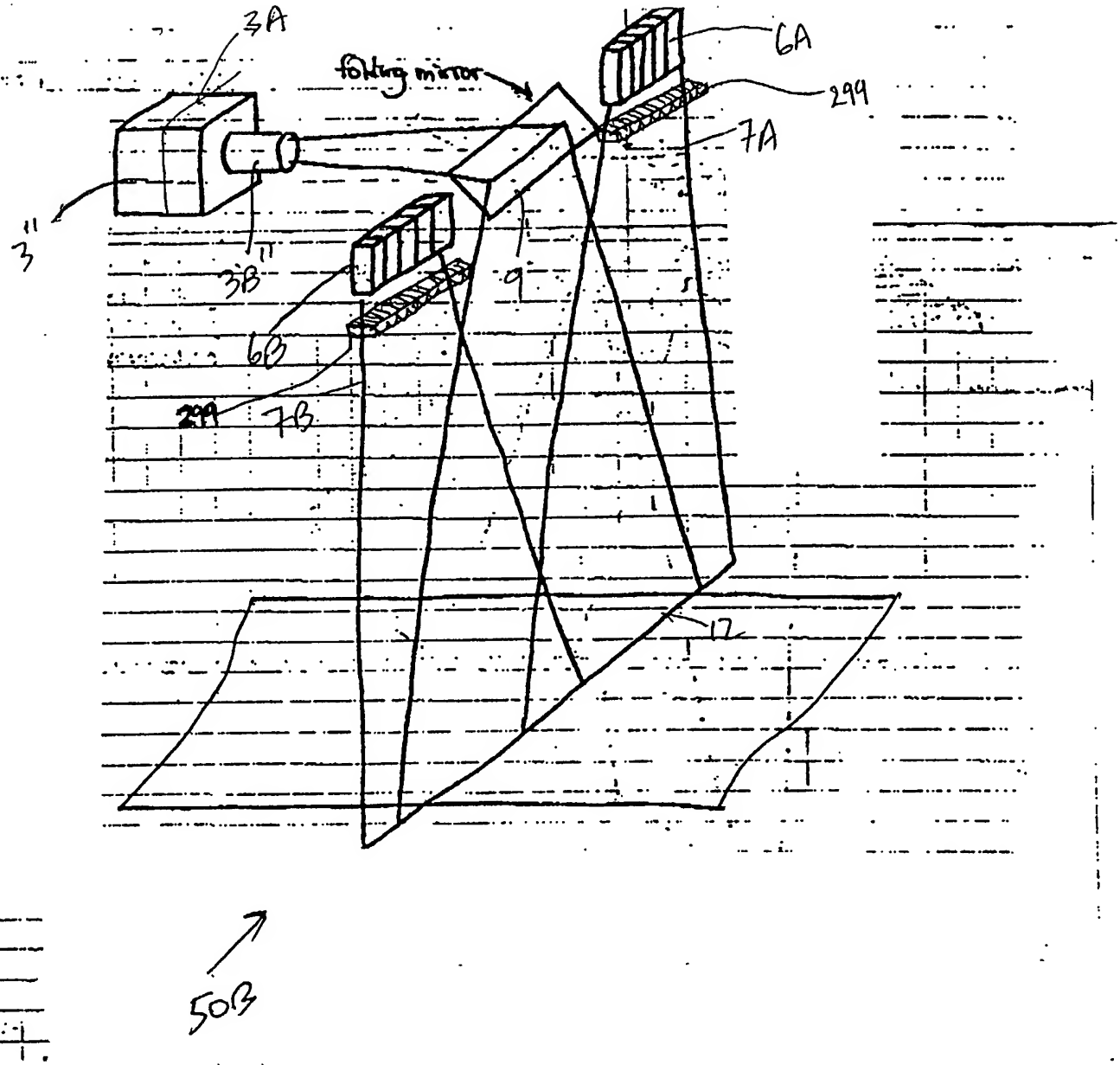


FIG. 3E1

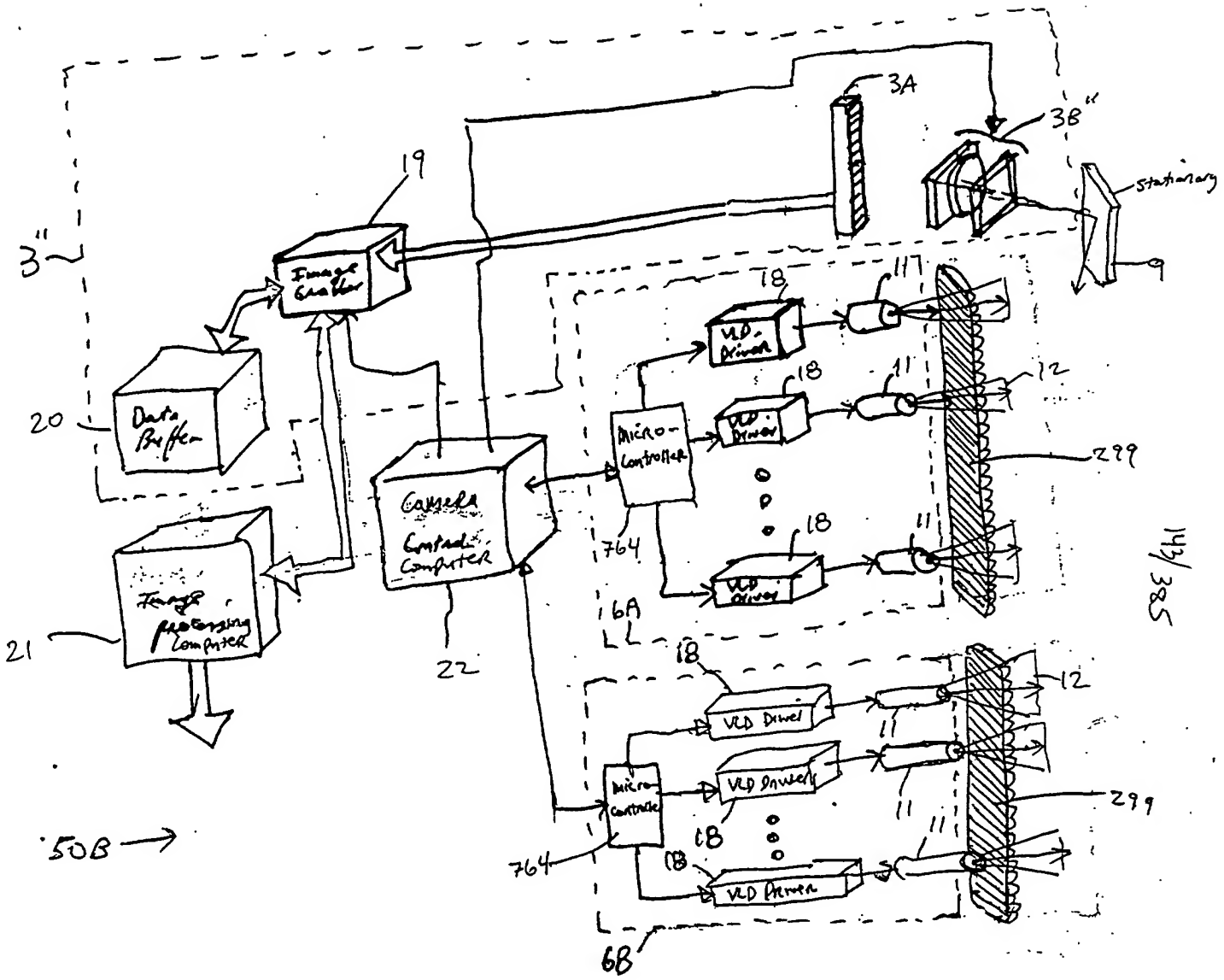


FIG. 3E2

20020220 - 2254320

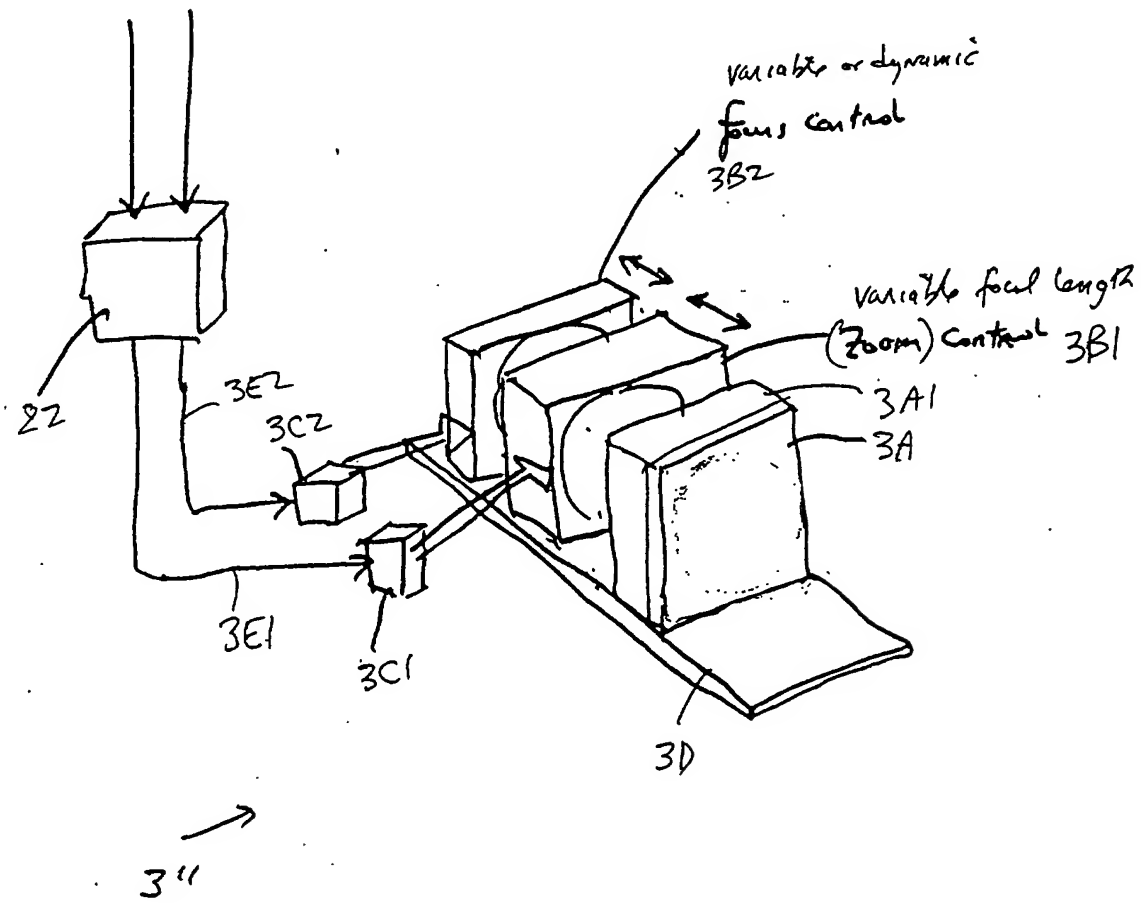


FIG. 3E3

20220227.0228+8800.1

145/385)

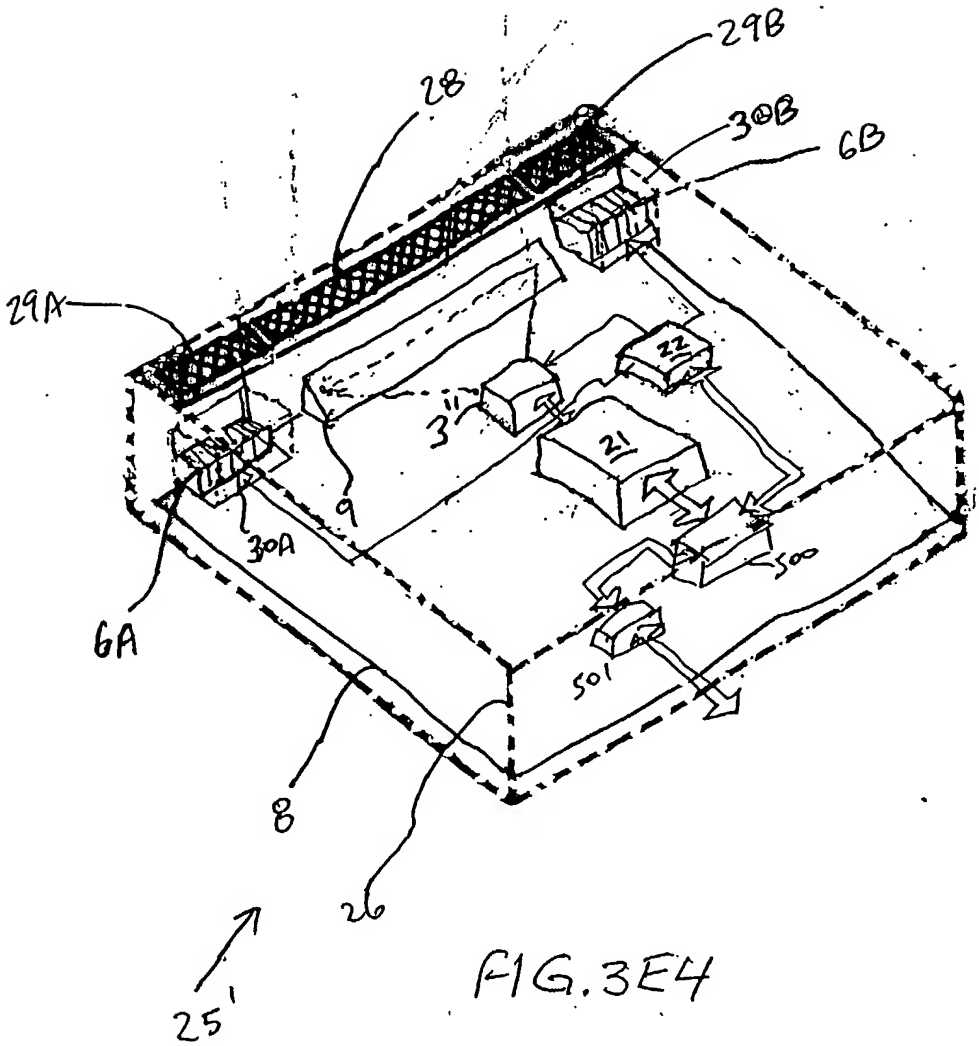


FIG. 3E4

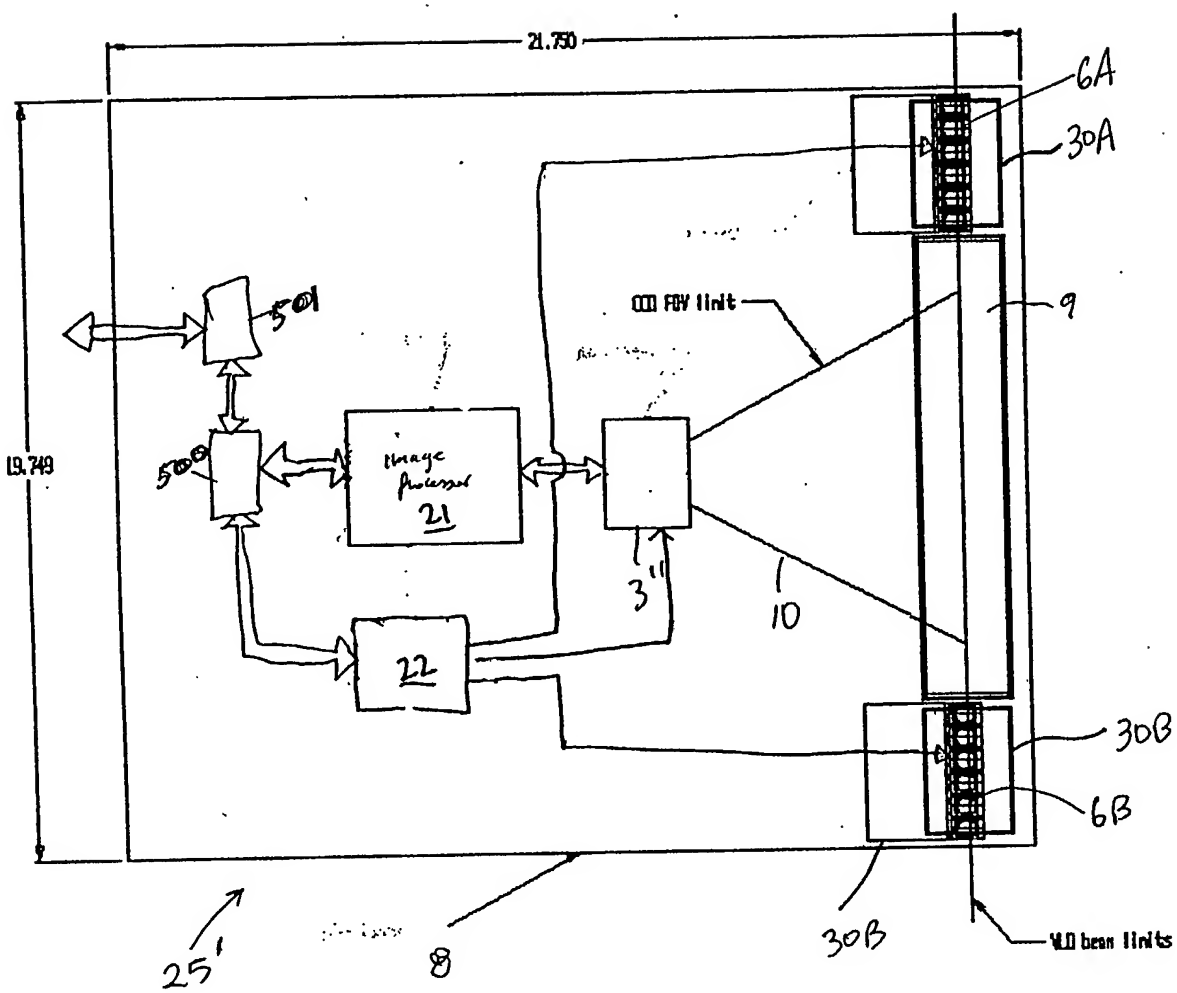

21.750
19.749
6A
30A
501
500
FOV limit
9
Image Processor
21
3
10
22
30B
6B
25
8
30B
LED beam limits

FIG. 3E5

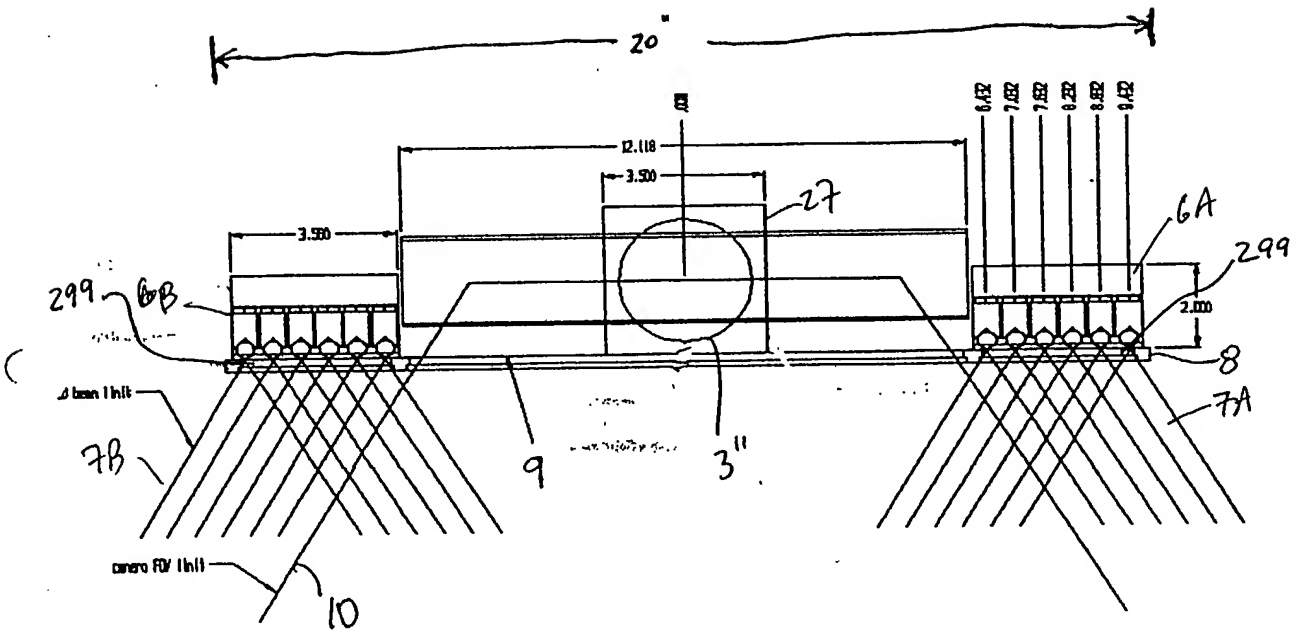


FIG. 3E6

148/385

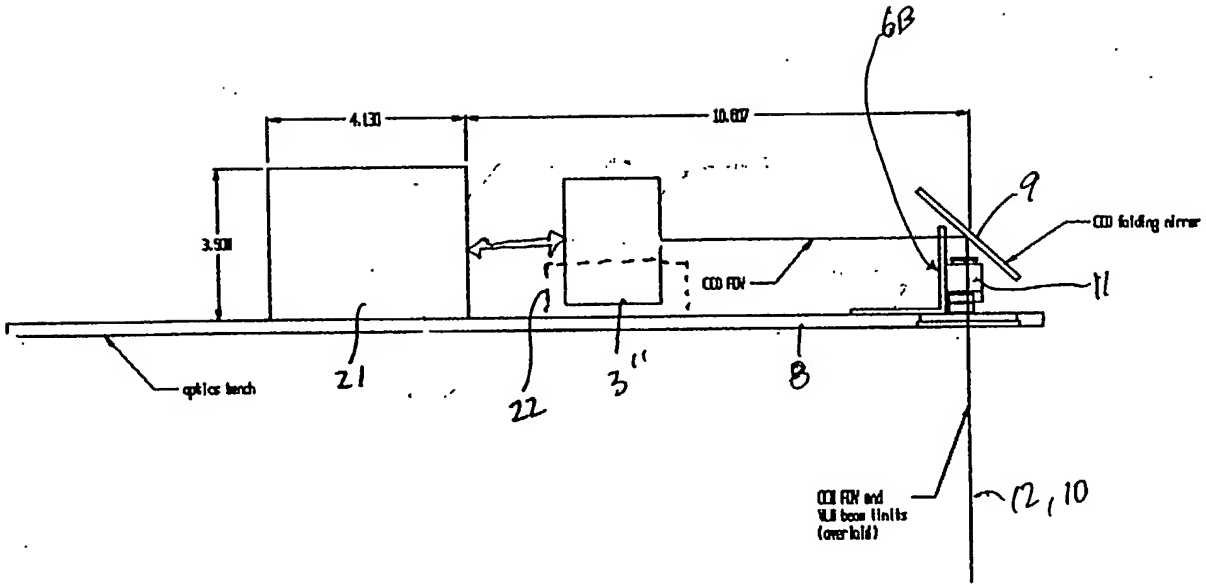


FIG. 3E7

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*variable FOV

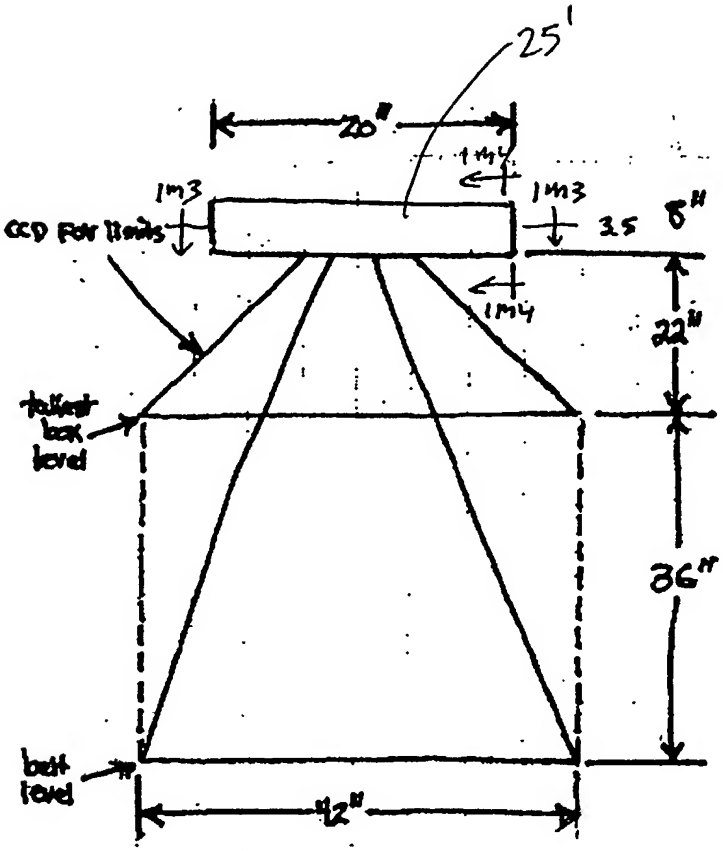

FIG. 3E8

150/385

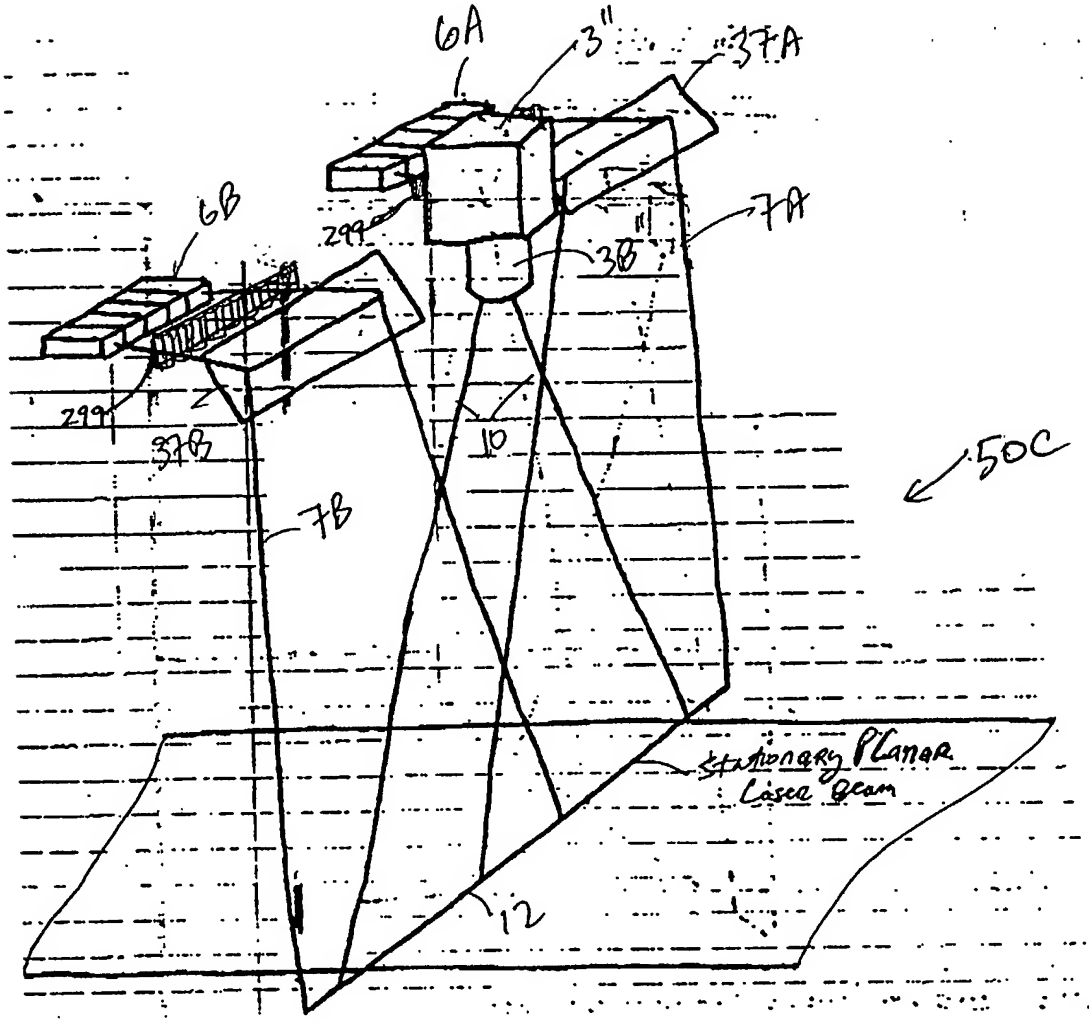

FIG. 3F1

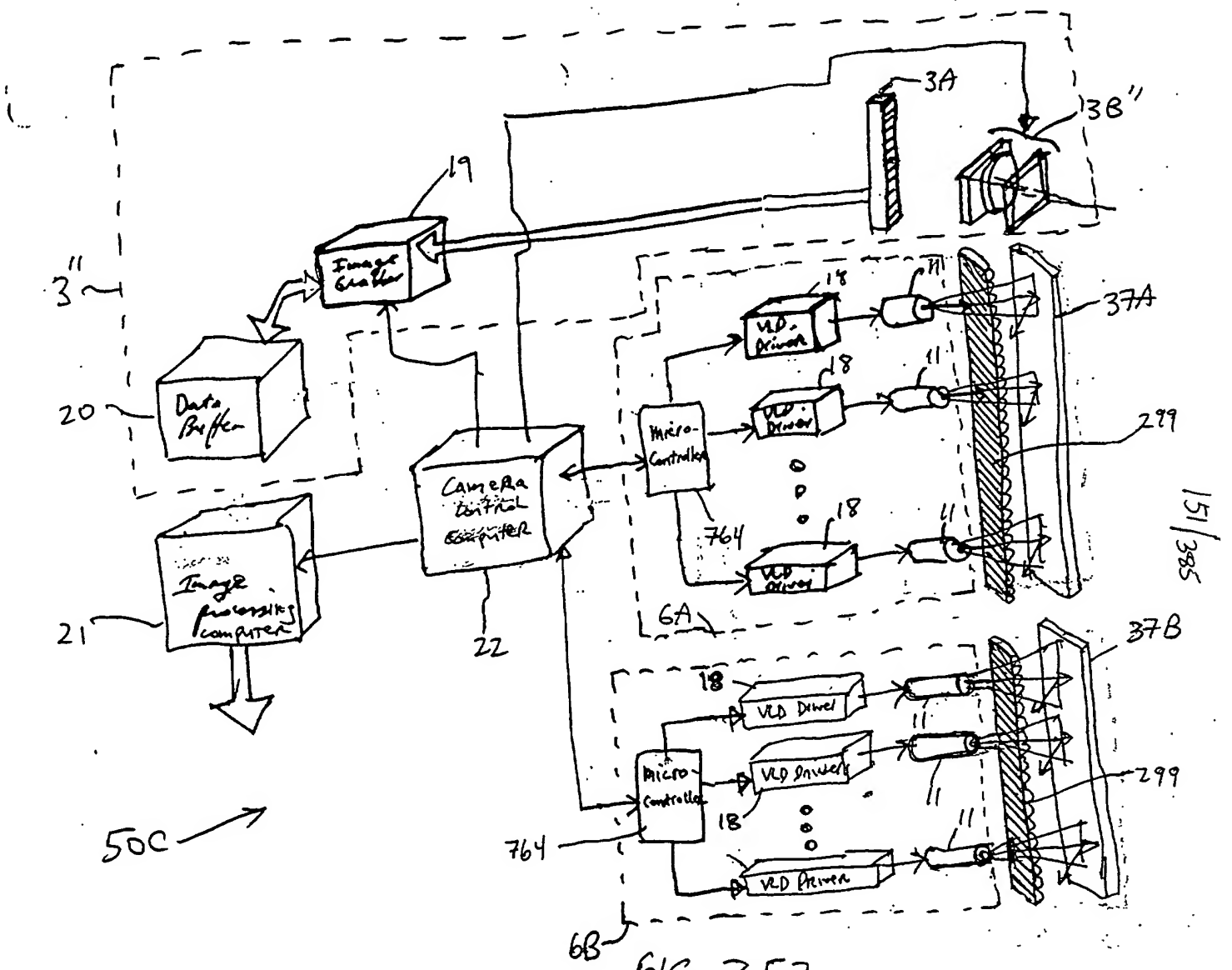
3A
38"
19
3"
Image Grabber
20
Data Buffer
Camera Control Computer
Micro-Controller
VLD Driver
18
11
37A
299
764
151/385
21
Image processing computer
22
6A
37B
50C
6B

FIG. 3F2

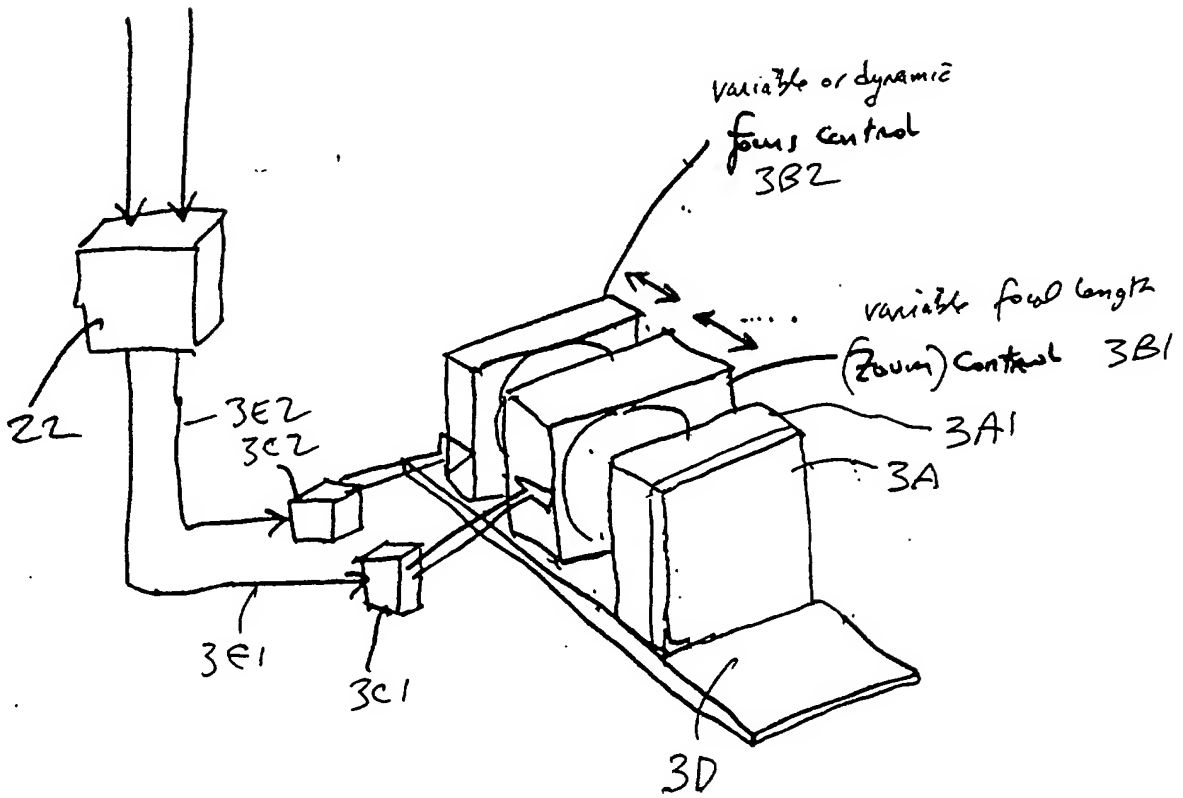

FIG. 3F3

20/22 "2243+3800"

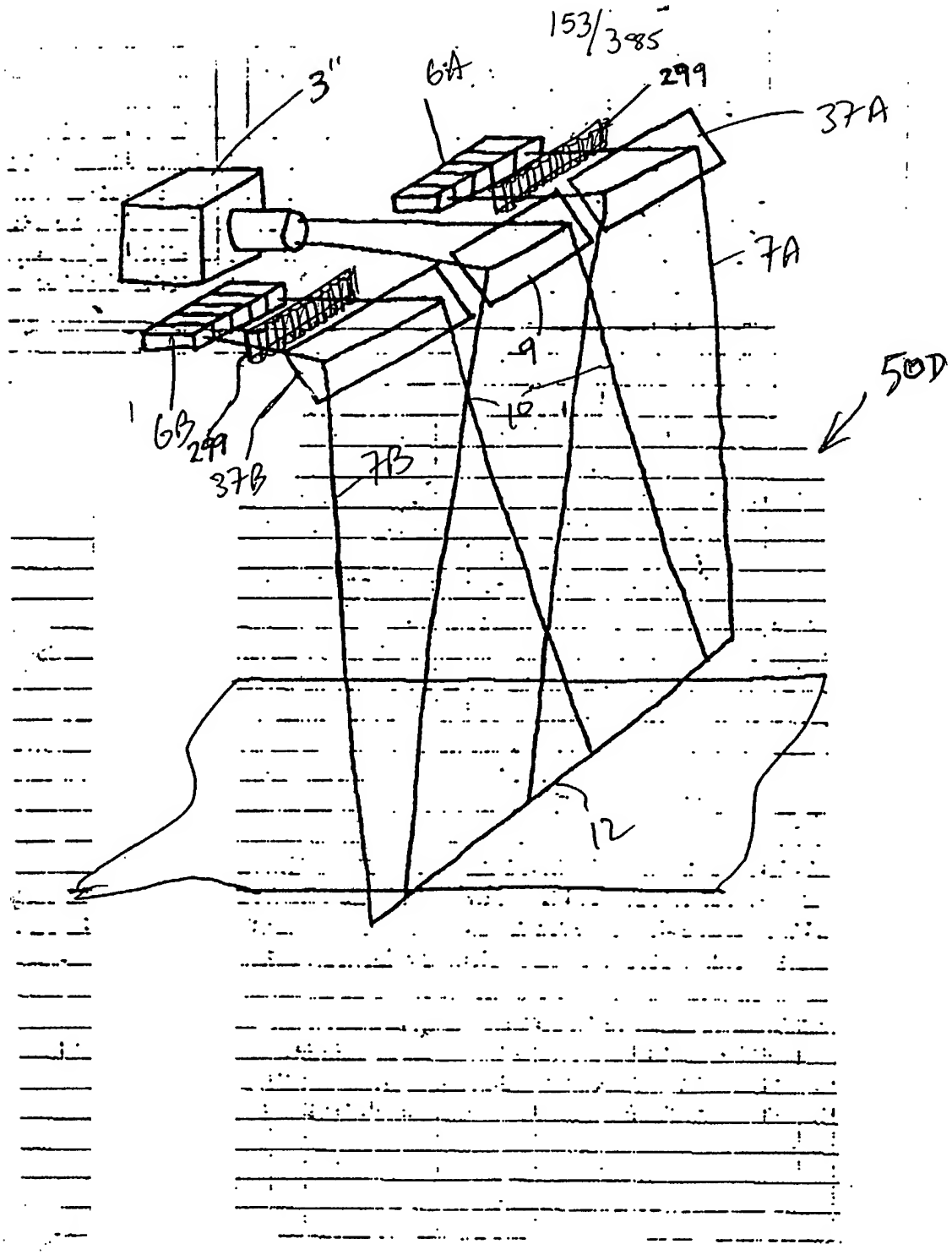

FIG. 3G1

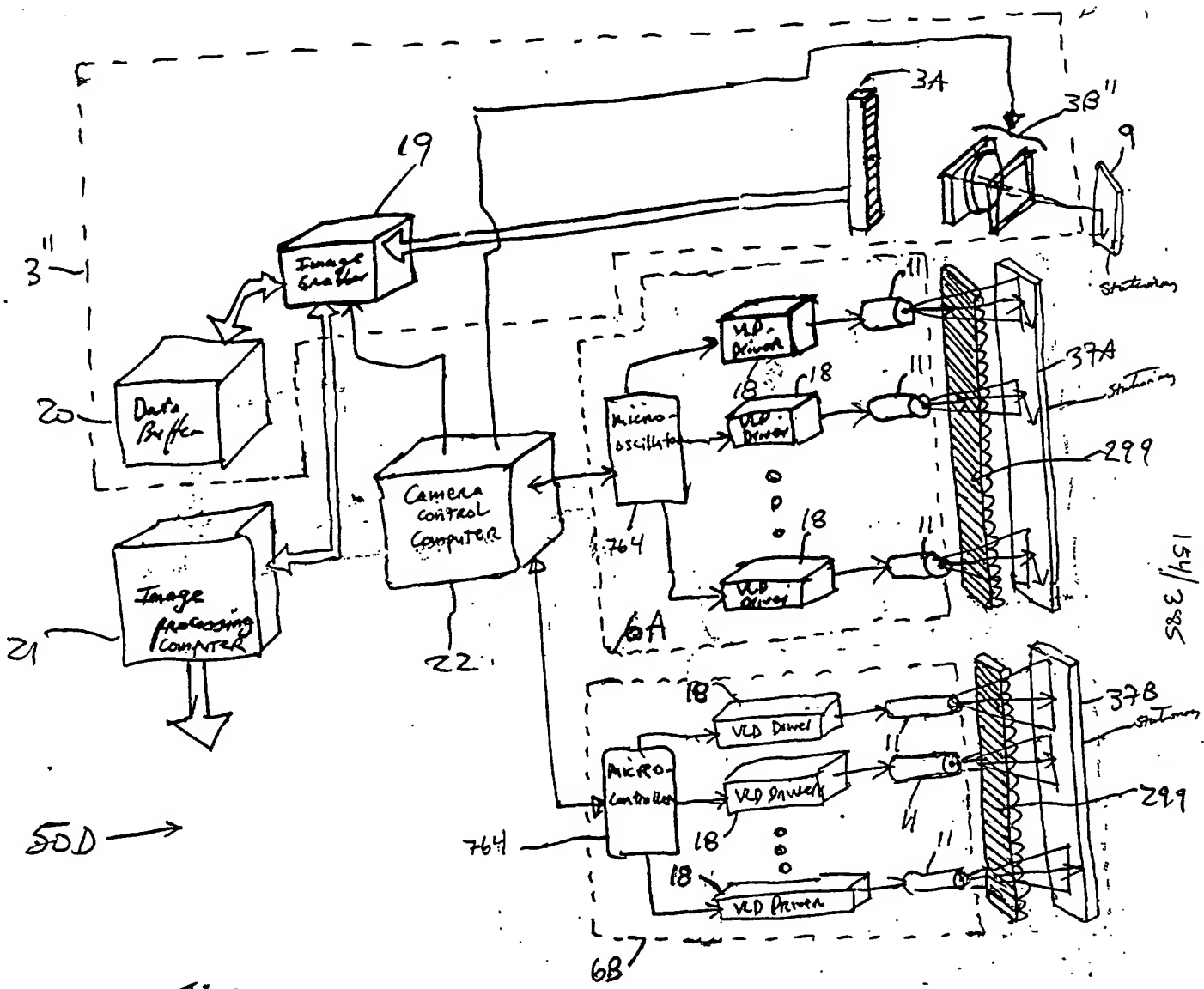
3A
3B''
9
19
3''
Image Grabber
Data Buffer
20
Camera control Computer
Image processing COMPUTER
21
22
VLD Driver
18
Micro-oscillator
764
37A
299
6A
154/385
37B
Micro-controller
50D
6B

FIG. 3G2

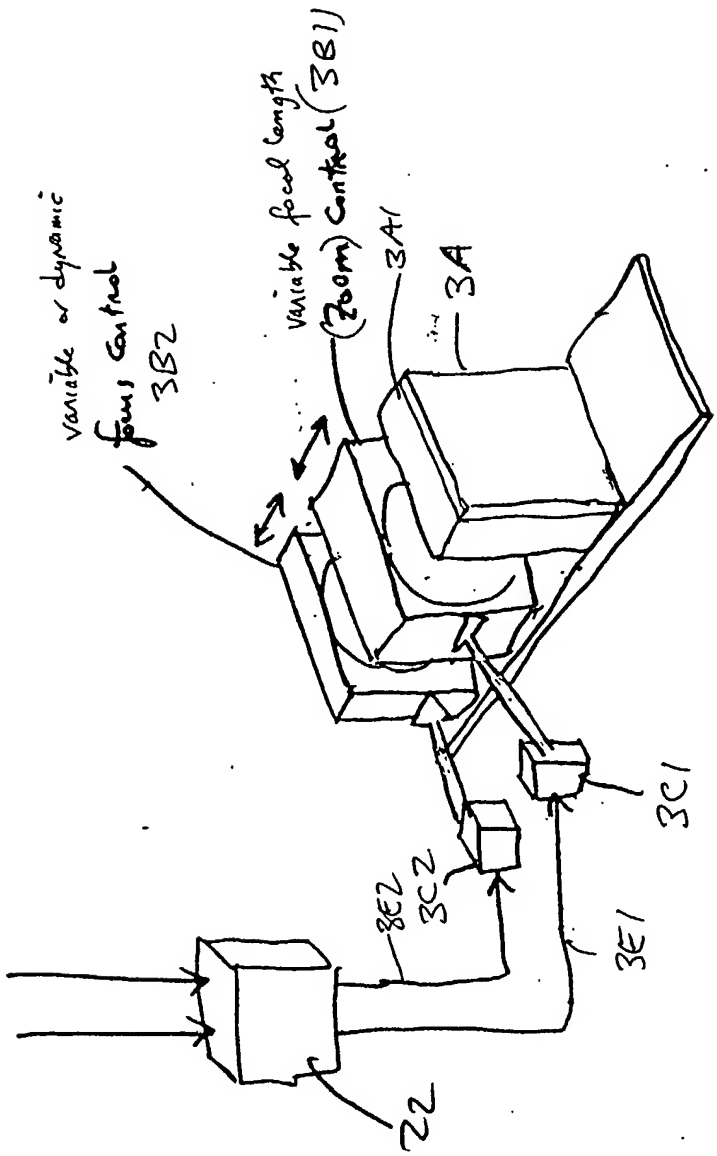
variable or dynamic
focus control
382
variable focal length
(zoom) control (381)
3A1
3A
3C1
3C2
3E2
3E1
22
311

FIG 36B

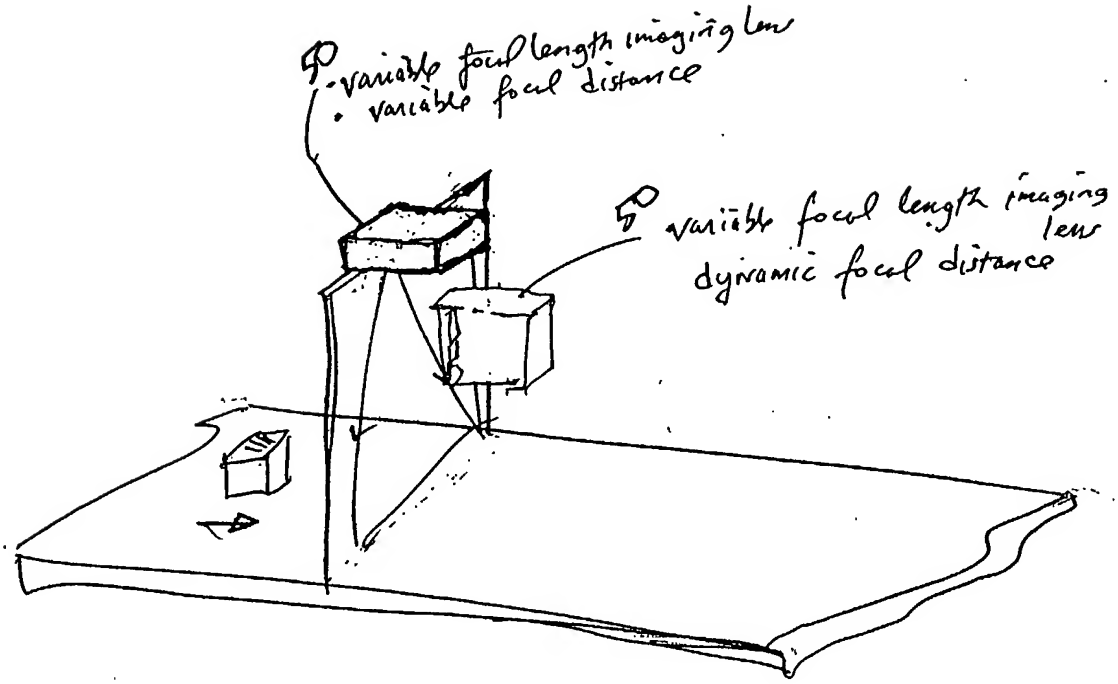
variable focal length imaging lens
variable focal distance
variable focal length imaging lens
dynamic focal distance

FIG. 3H

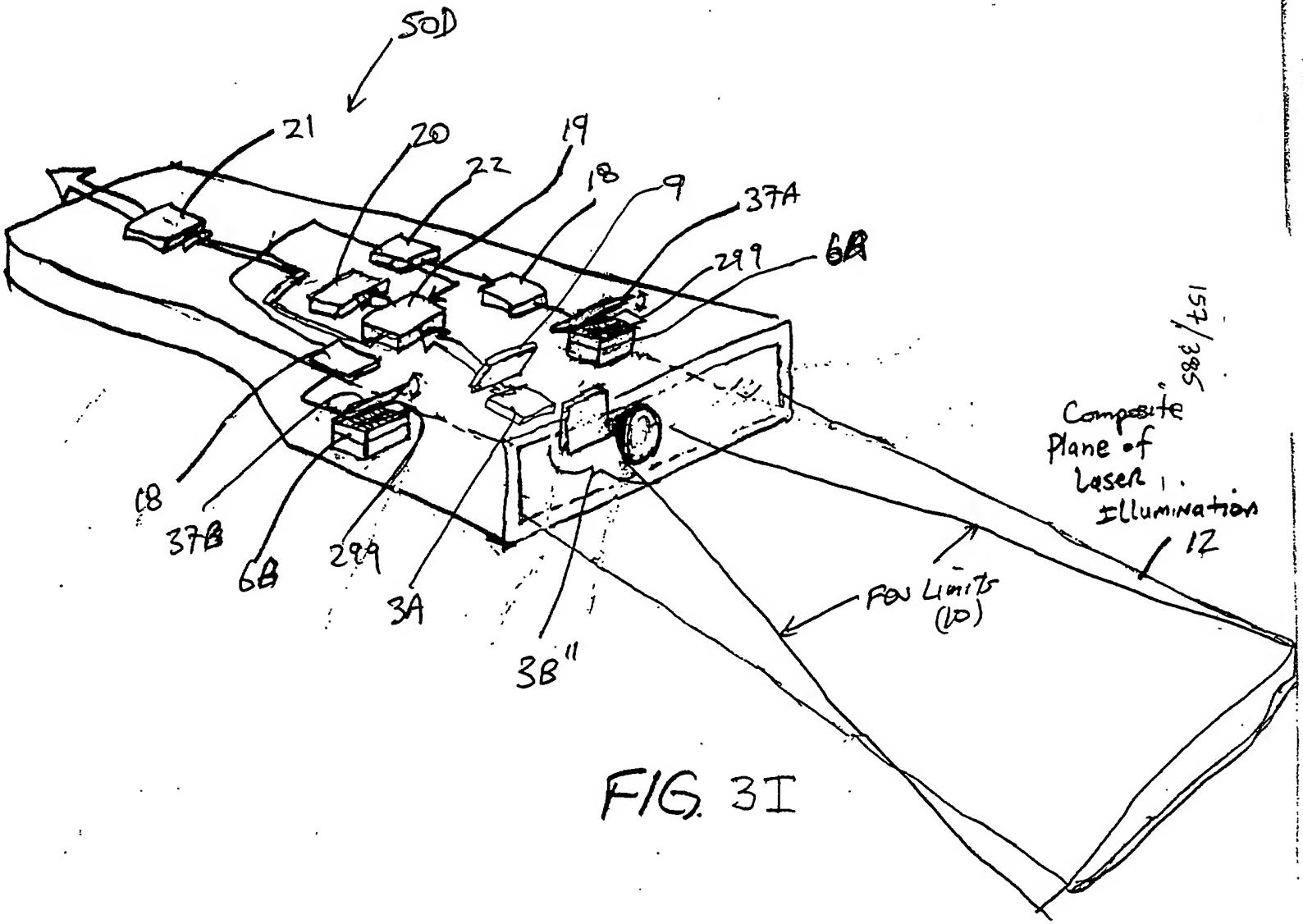
50D
21
20
22
19
18
9
37A
299
6B
157/385
Composite
Plane of
Laser
Illumination
12
FOV Limits
(10)
18
37B
6B
299
3A
3B"

FIG. 3I

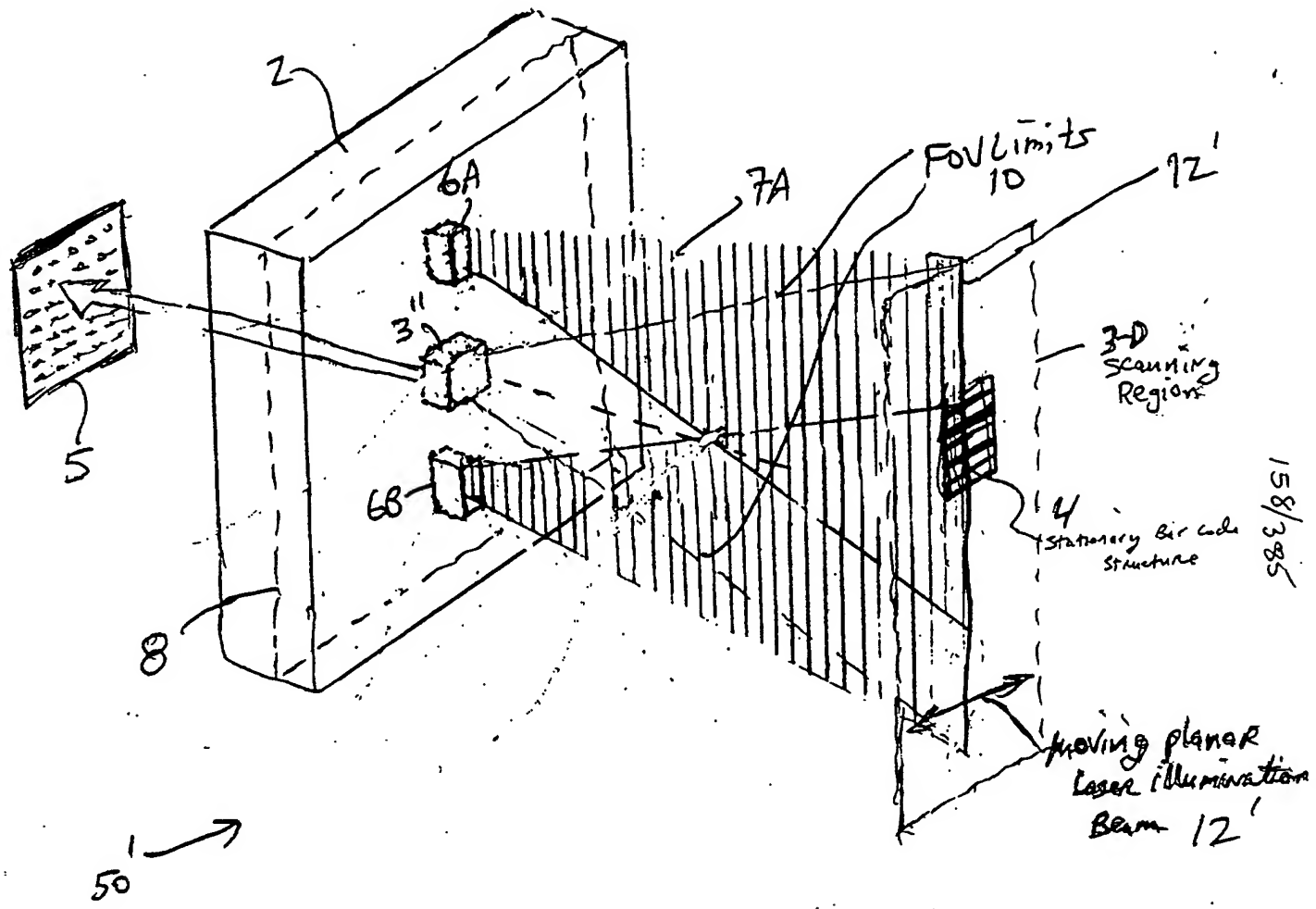

FIG. 3J1

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20220210 2220 4800 1

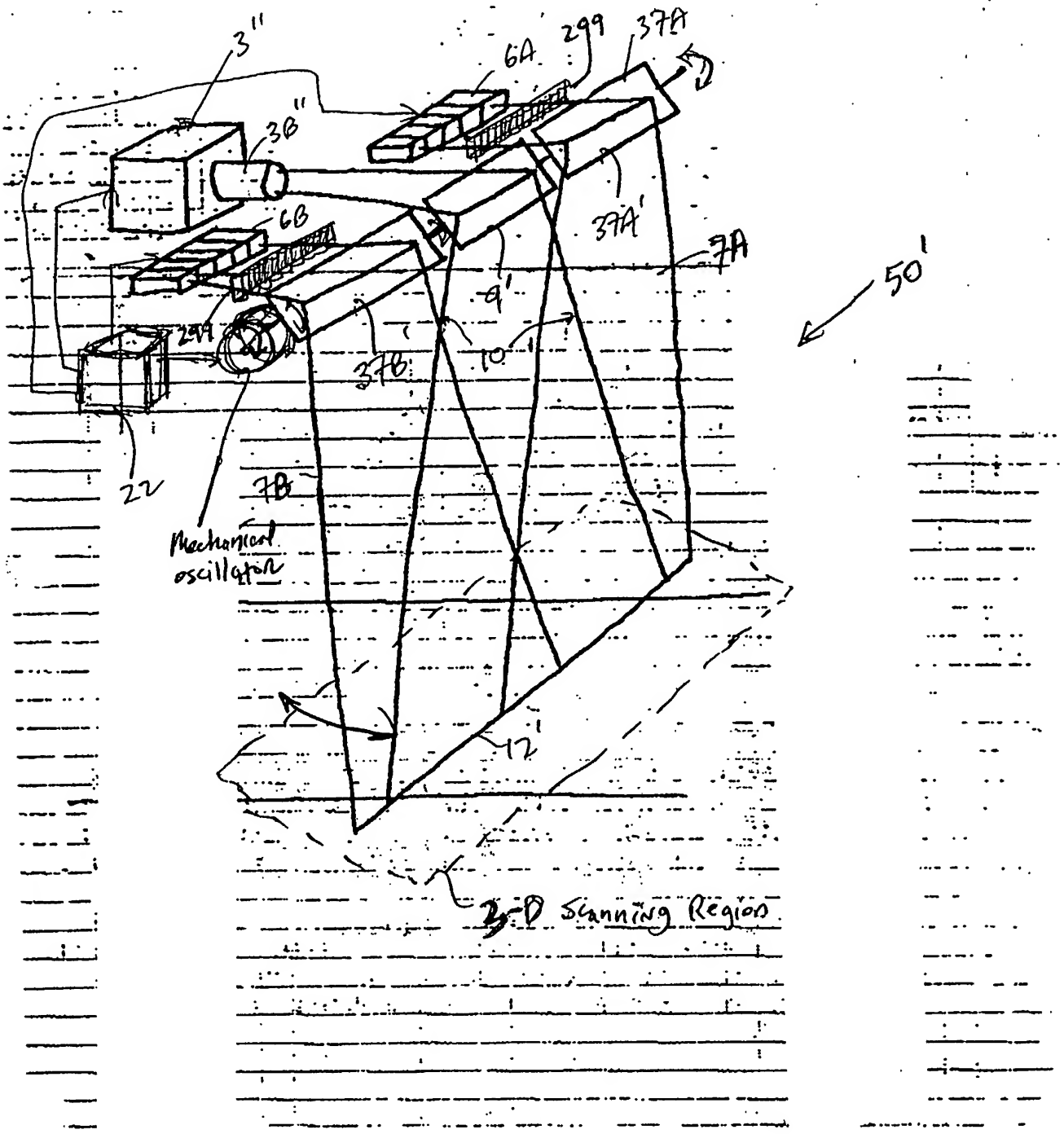

3''
6A
299
37A
30''
6B
37A'
7A
50'
9'
299
37B
10'
22
7B
Mechanical oscillator
12'
3-D Scanning Region

FIG 3J2

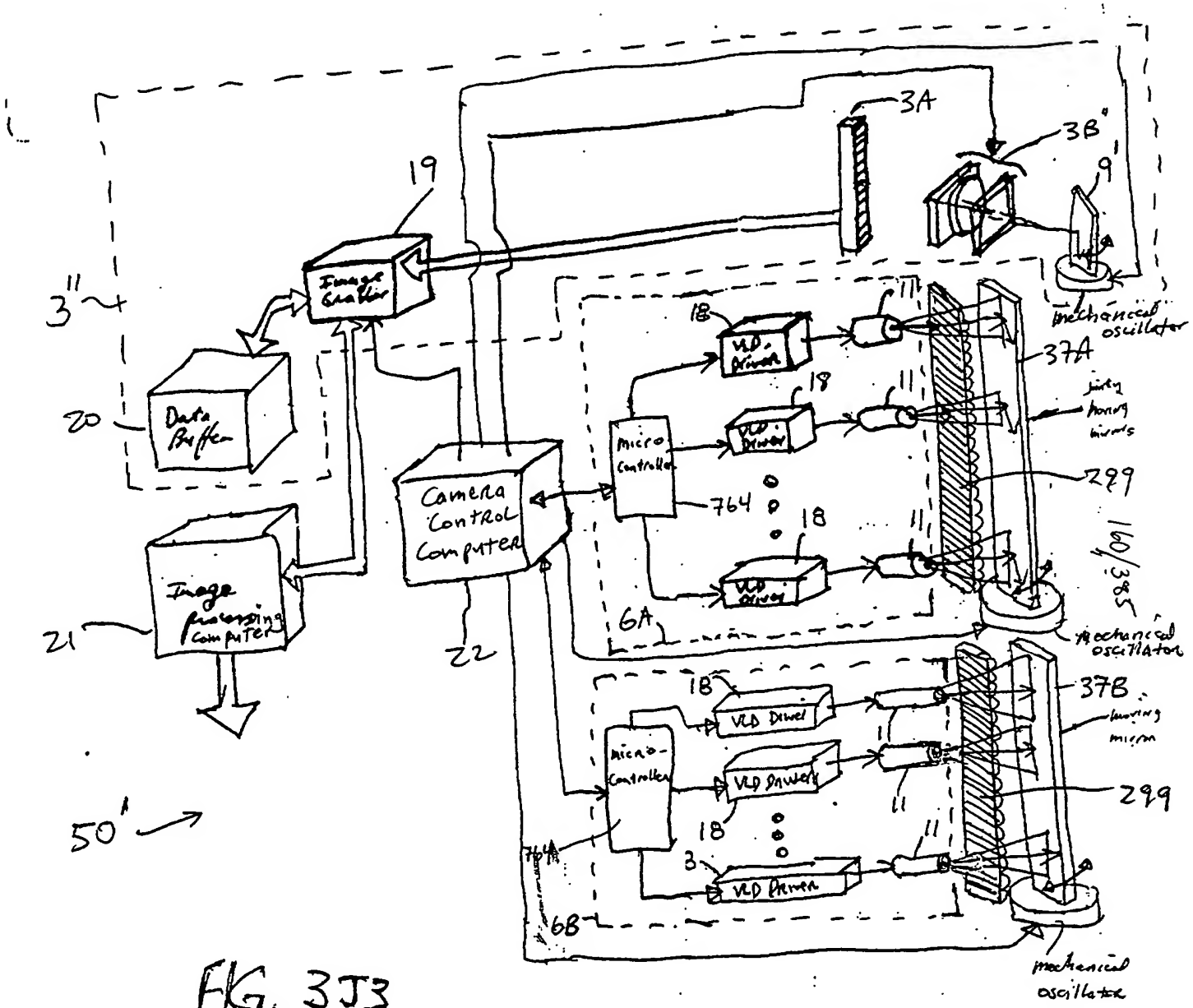


FIG. 3J3

20020180007

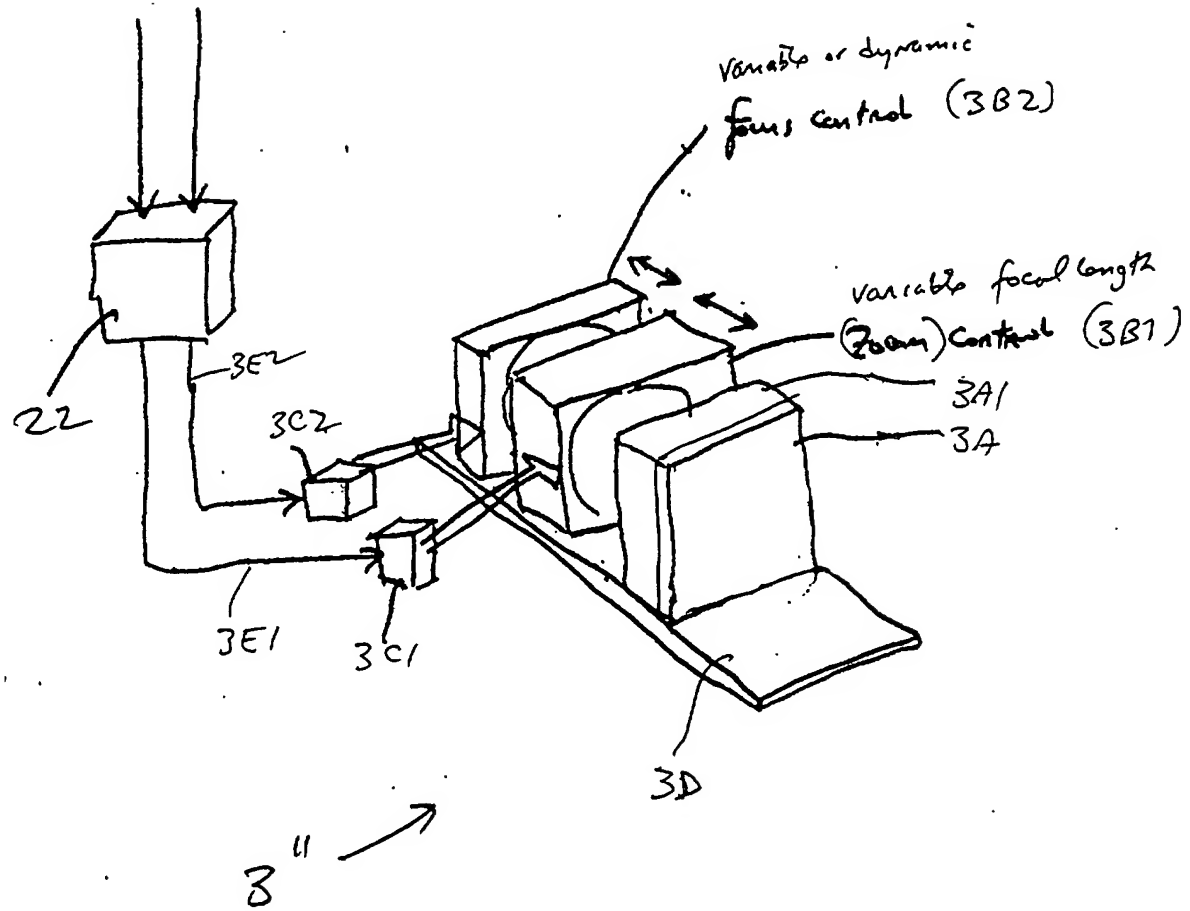


FIG. 3J4

SHEET 191
20120220:4223

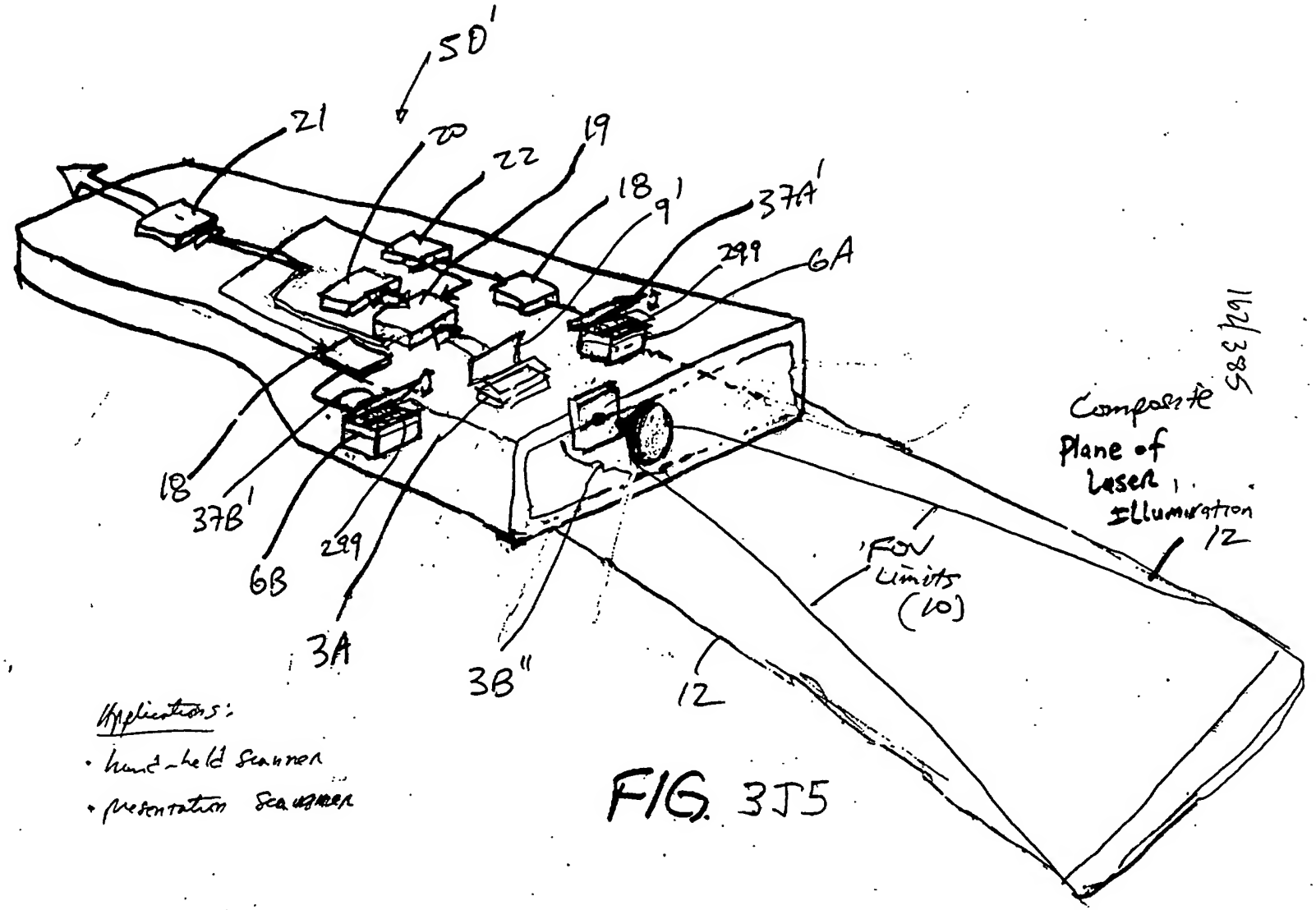
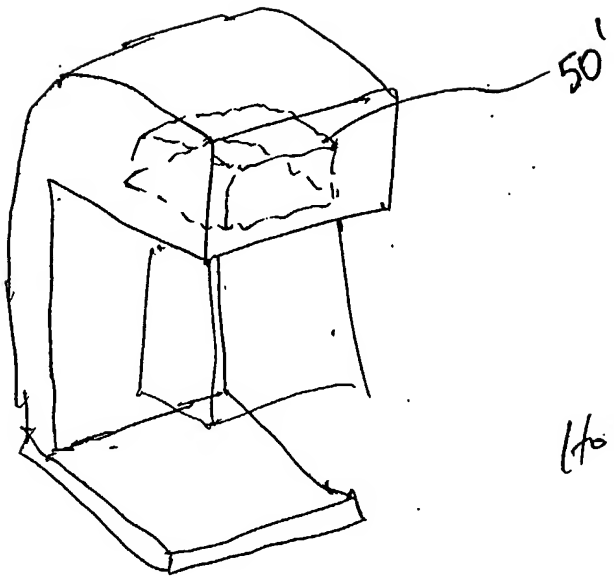


FIG. 3J5

20220220" 2220+0007E



2-D
Hold-under
scanner

FIG-3J6

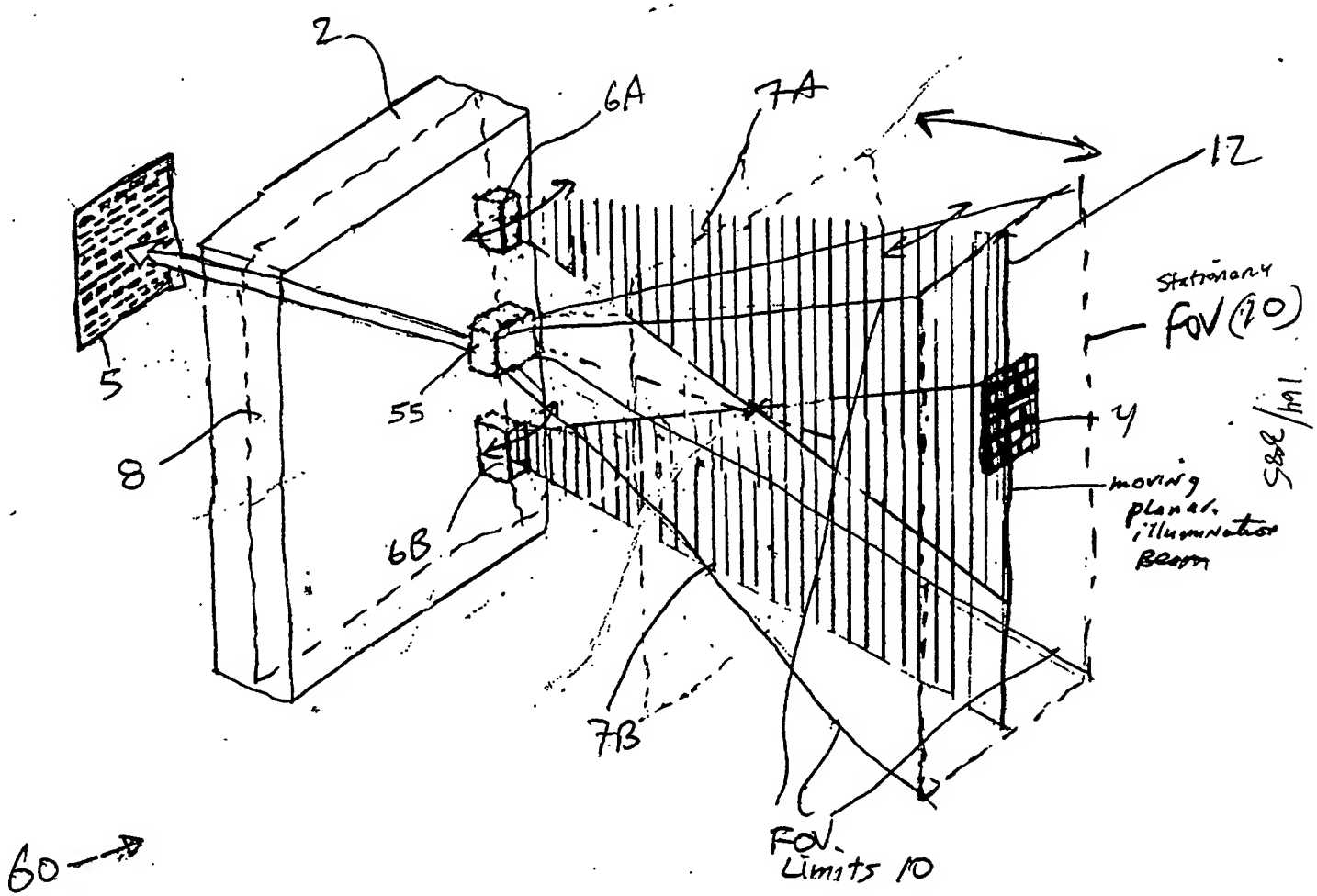

2
6A
7A
12
Stationary
FOV (10)
5
55
y
8
moving
planar
illumination
Beam
6B
7B
60
FOV
Limits 10

FIG 4A

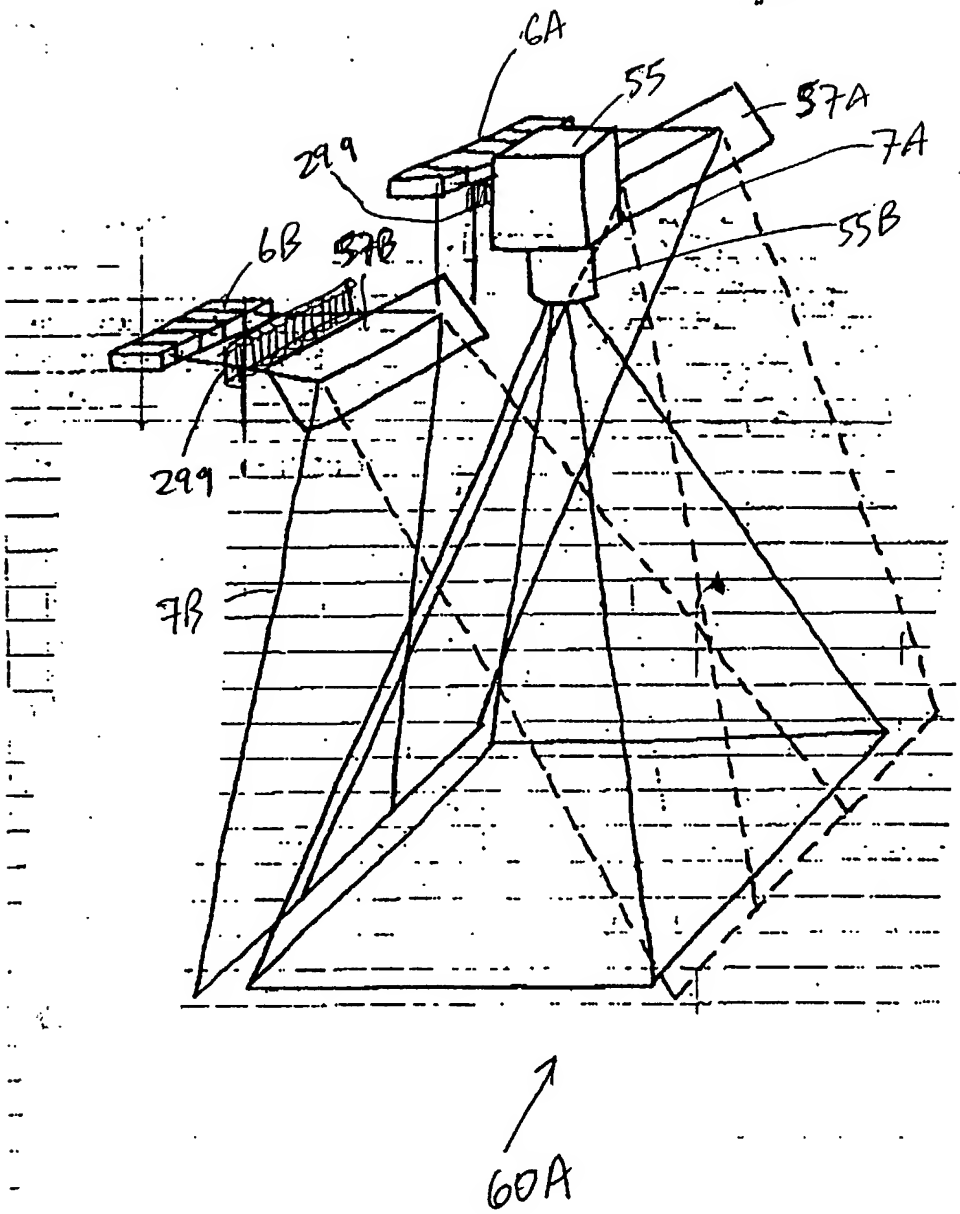


FIG. 4B1

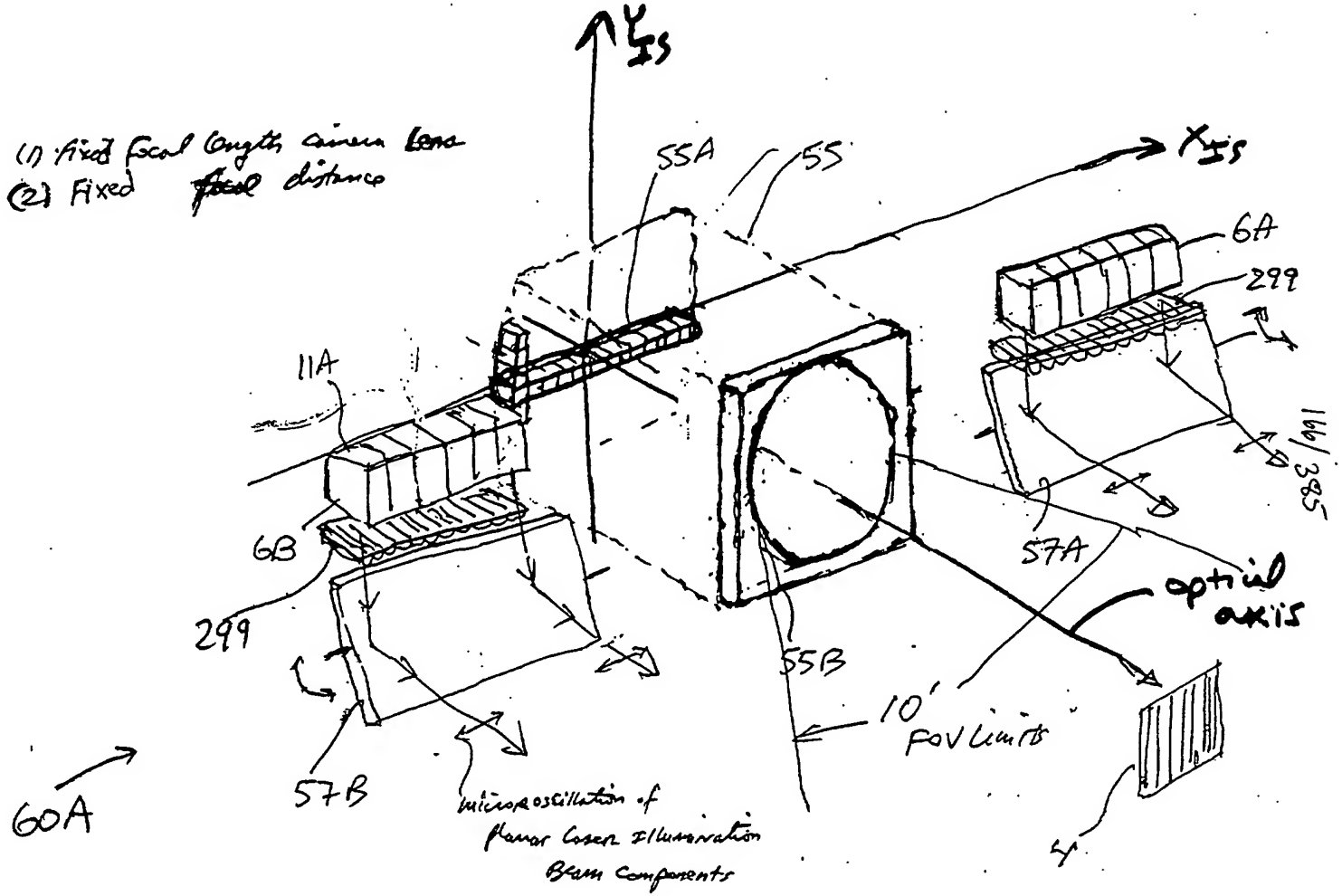

(1) Fixed focal length camera lens
(2) Fixed ~~focal~~ distance
55A
55
6A
299
11A
6B
299
57A
optical axis
55B
10° FOV limits
57B
60A
Microoscillation of planar laser illumination beam components
4

FIG. 4B.2

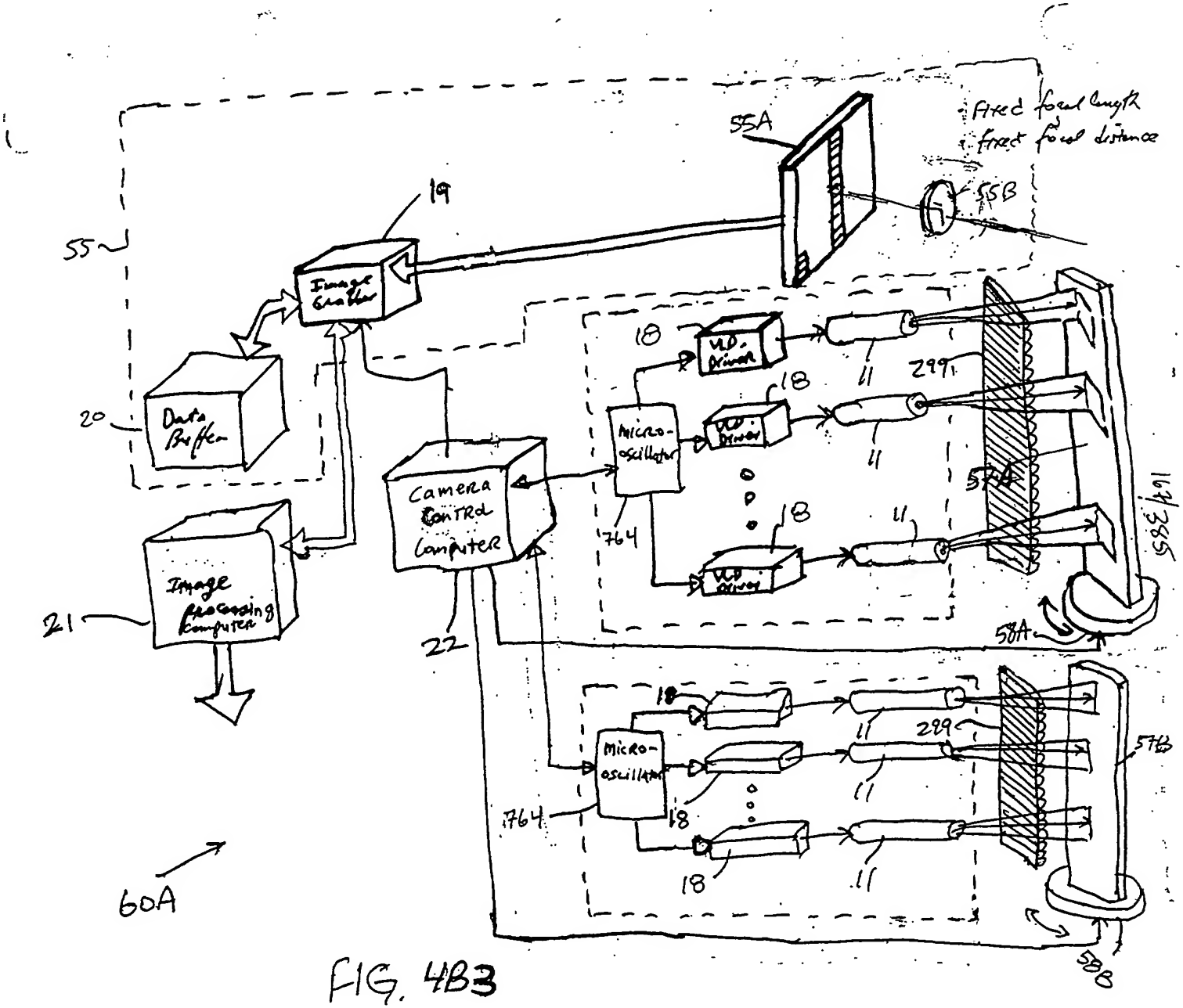

55A
Fixed focal length
fixed focal distance
55B
55
19
Image Grabber
20
Data Buffer
21
Image Processing Computer
22
Camera Control Computer
764
Micro-oscillator
18
VCO Driver
299
11
57A
58A
169/385
57B
58B
60A

FIG. 4B3

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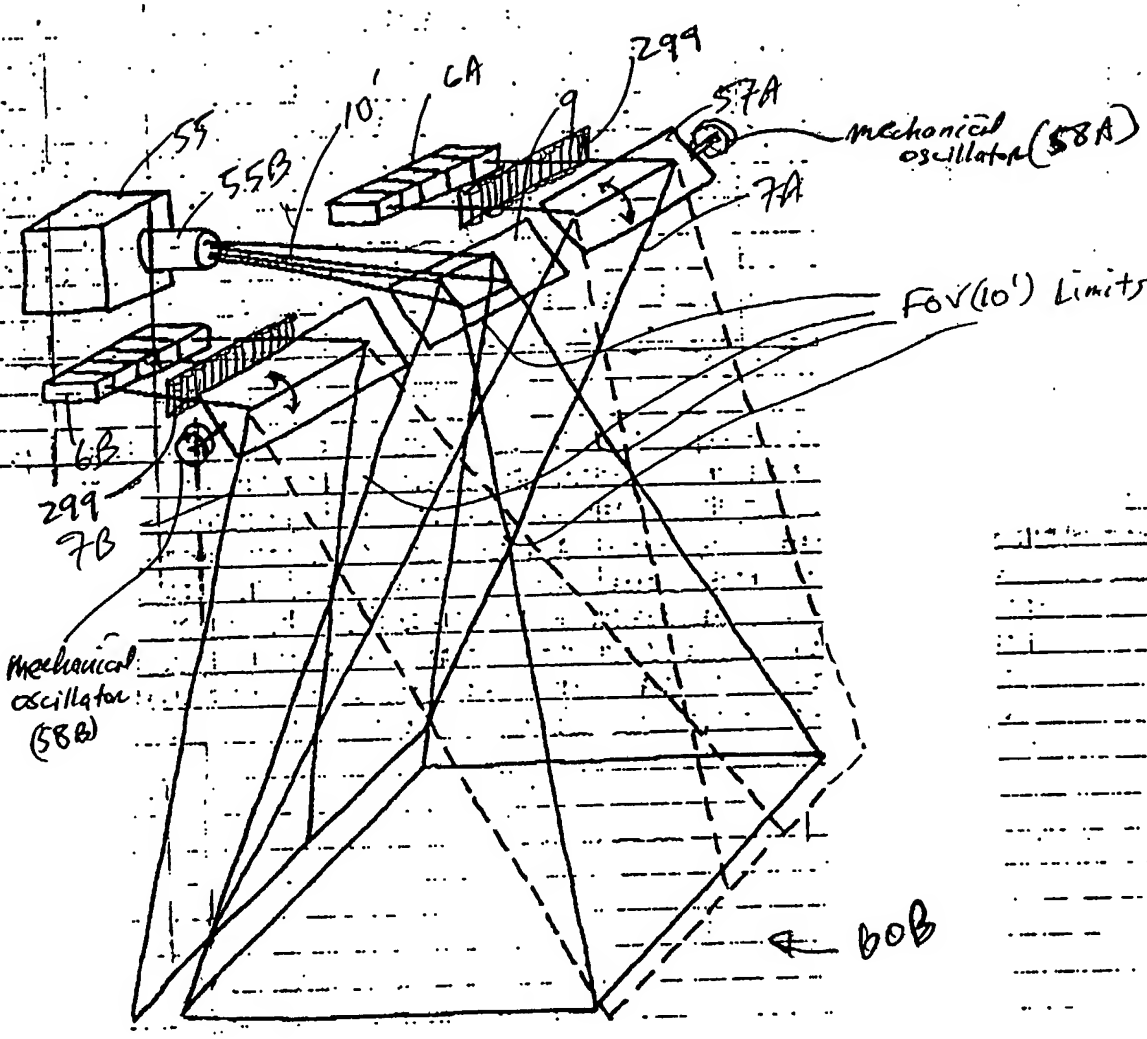

FIG. 4C1

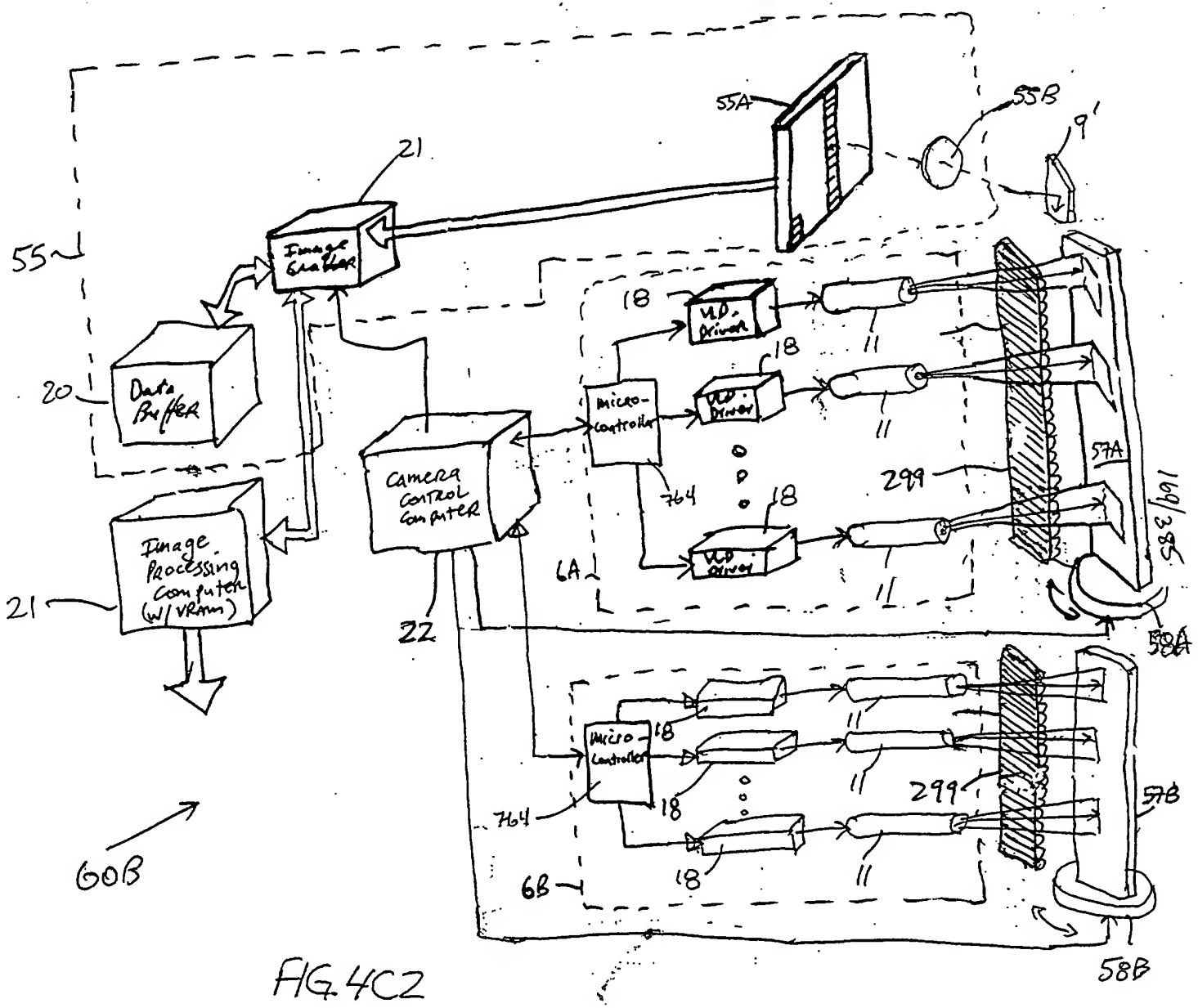
55A
55B
9'
21
55
Image Grabber
18
VLD driver
18
20
Data Buffer
Micro-controller
VLD driver
57A
764
299
18
Camera Control Computer
169/385
VLD driver
LA
21
Image Processing Computer (w/ VRam)
22
58A
Micro-controller
18
764
18
299
57B
18
6B
58B
60B

FIG. 4C2

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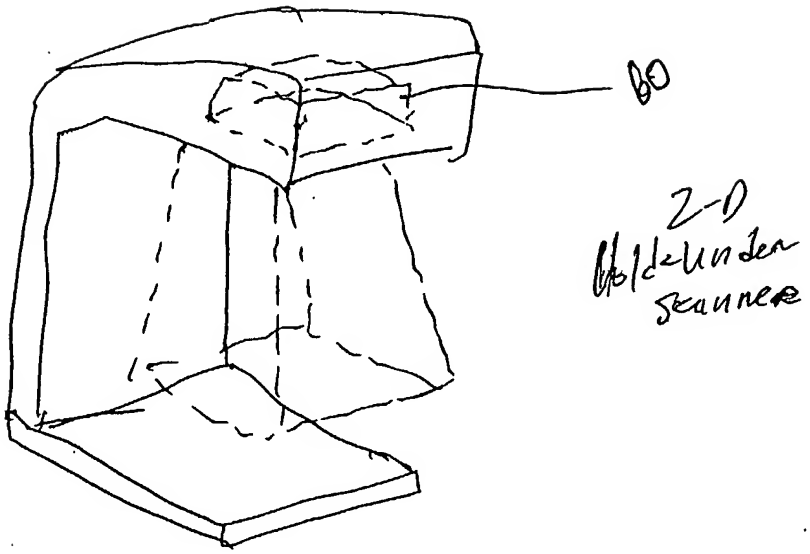
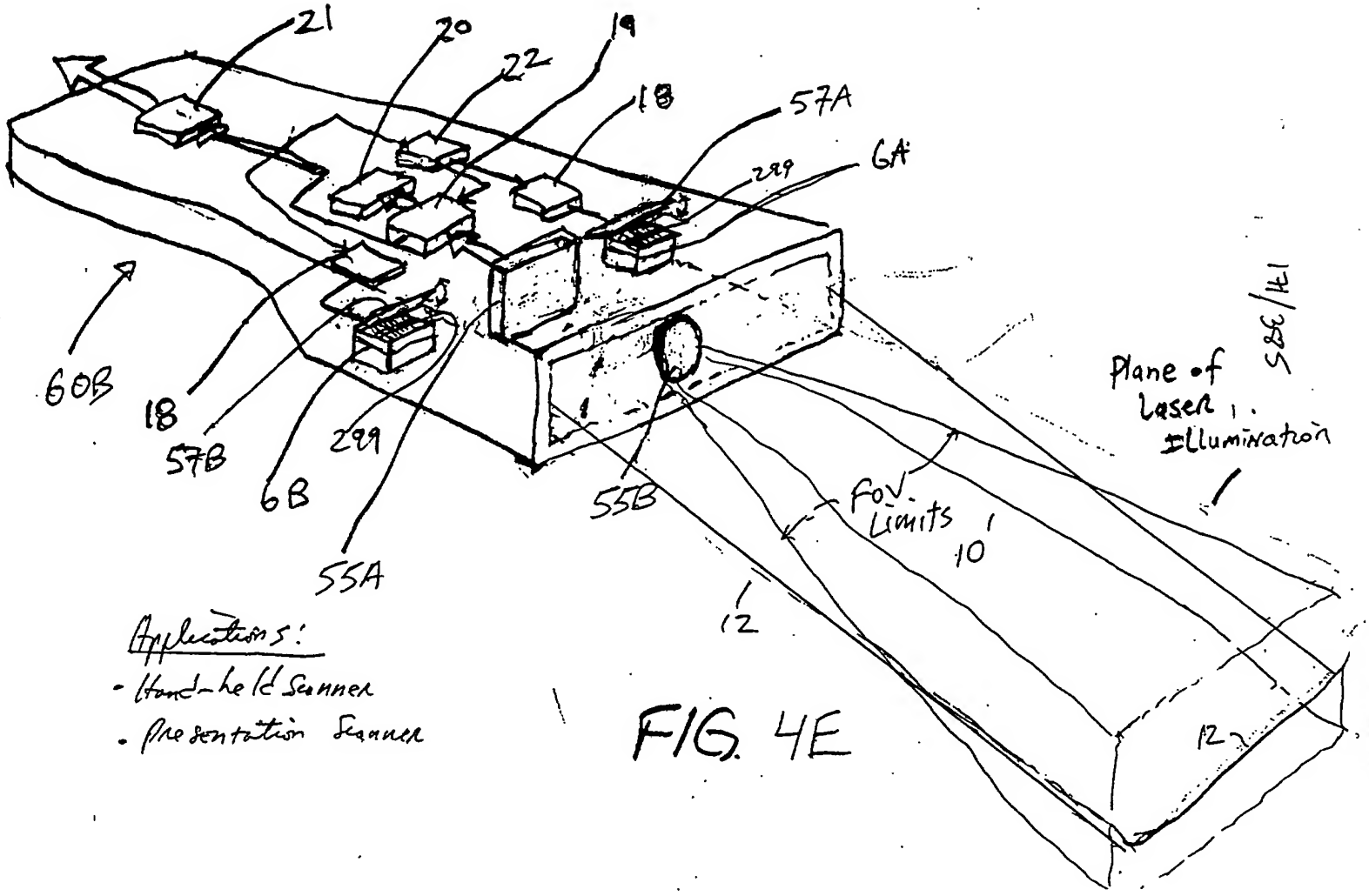


FIG. 4D



Applications:
- Hand-held Scanner
- Presentation Scanner

FIG. 4E

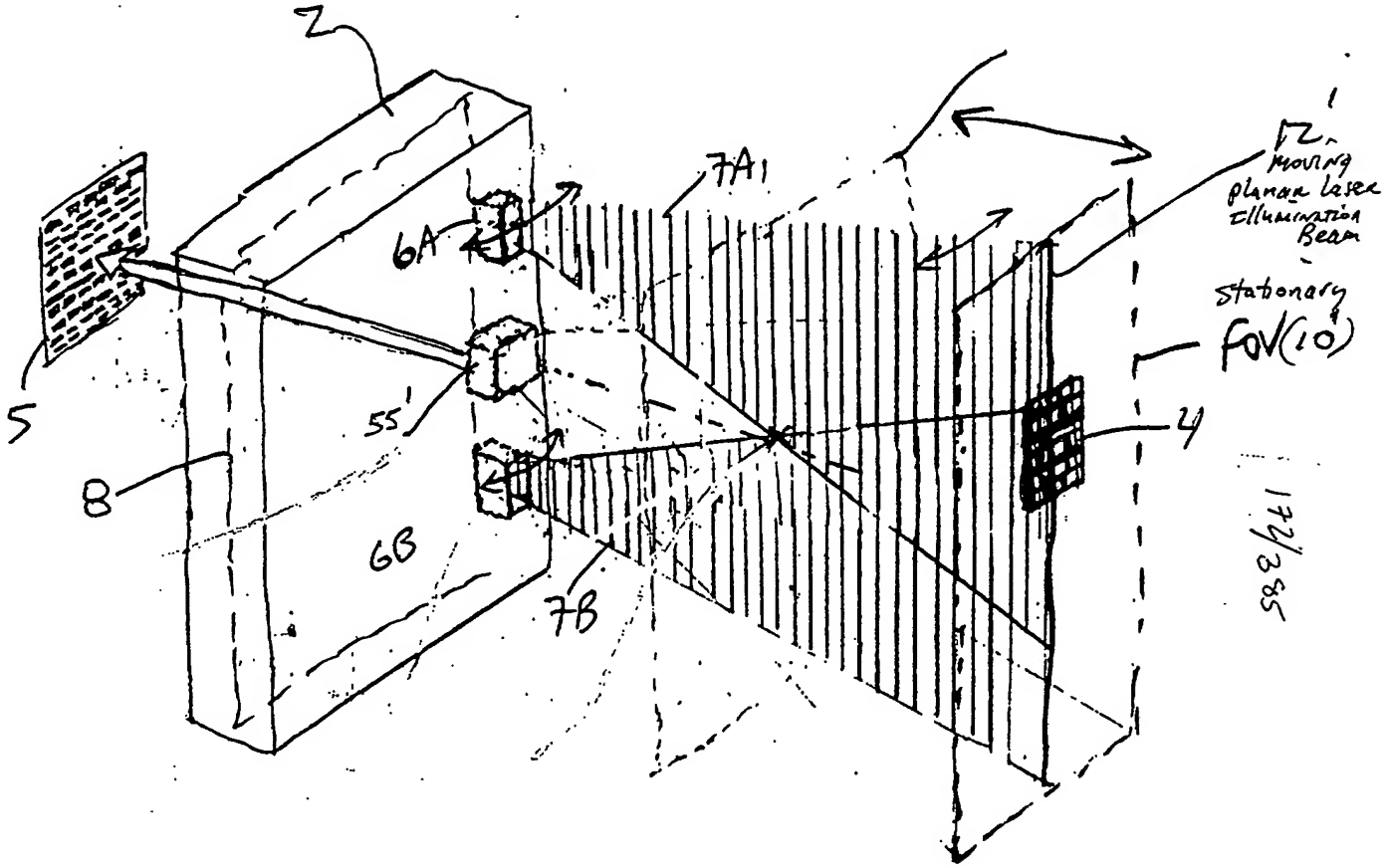


FIG 5A

20220220457 A1 20220728

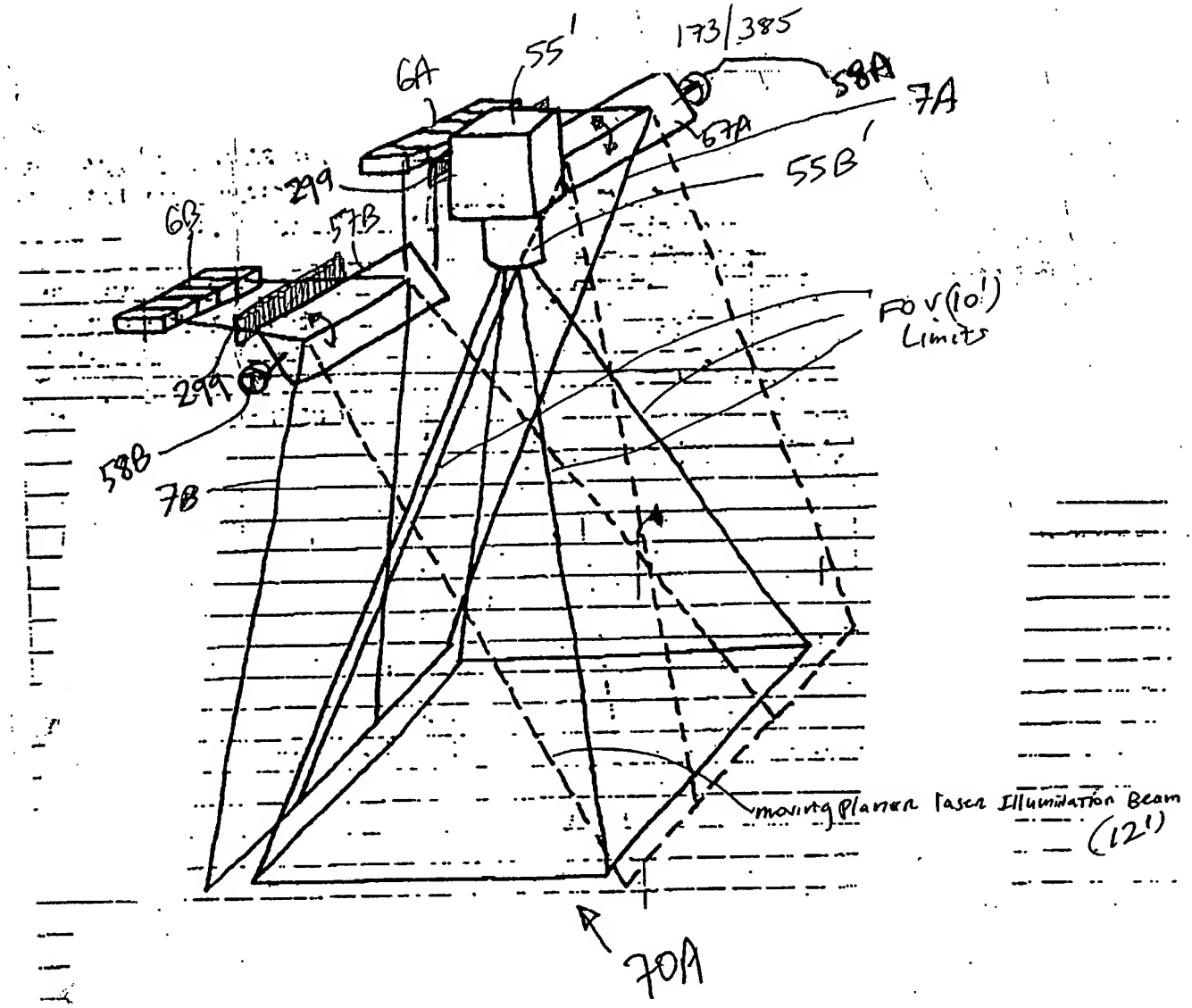

173/385
55'
6A
58A
7A
67A
55B'
299
6B
57B
FOV (10')
Limits
299
58B
7B
moving Planar Laser Illumination Beam
(12')
70A

FIG. 5B1

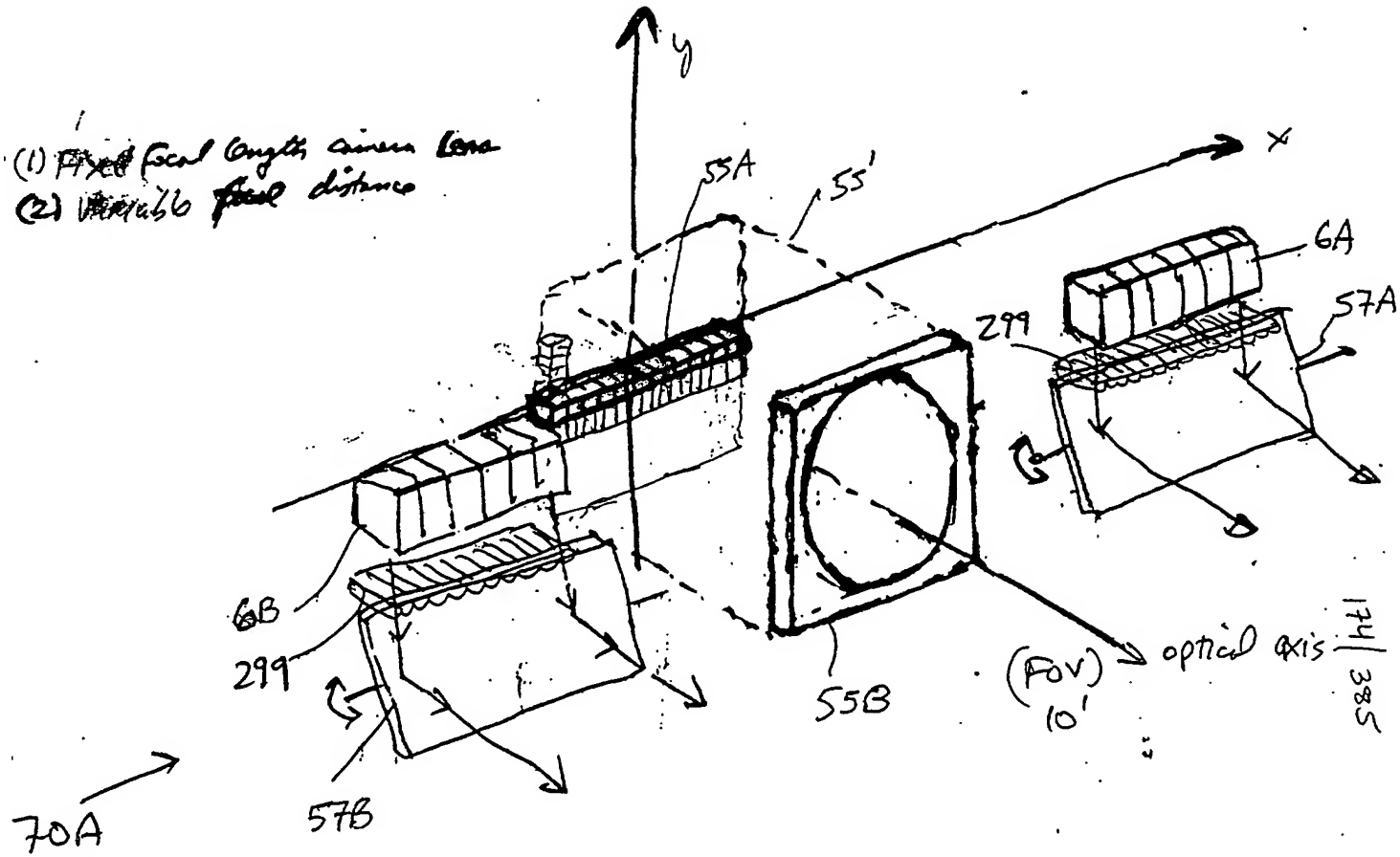

(1) Fixed focal length zoom lens
(2) variable focal distance
y
x
55A
55'
6A
57A
299
6B
299
55B
(FOV)
10'
optical axis
174
385
70A
57B

FIG. 5B2

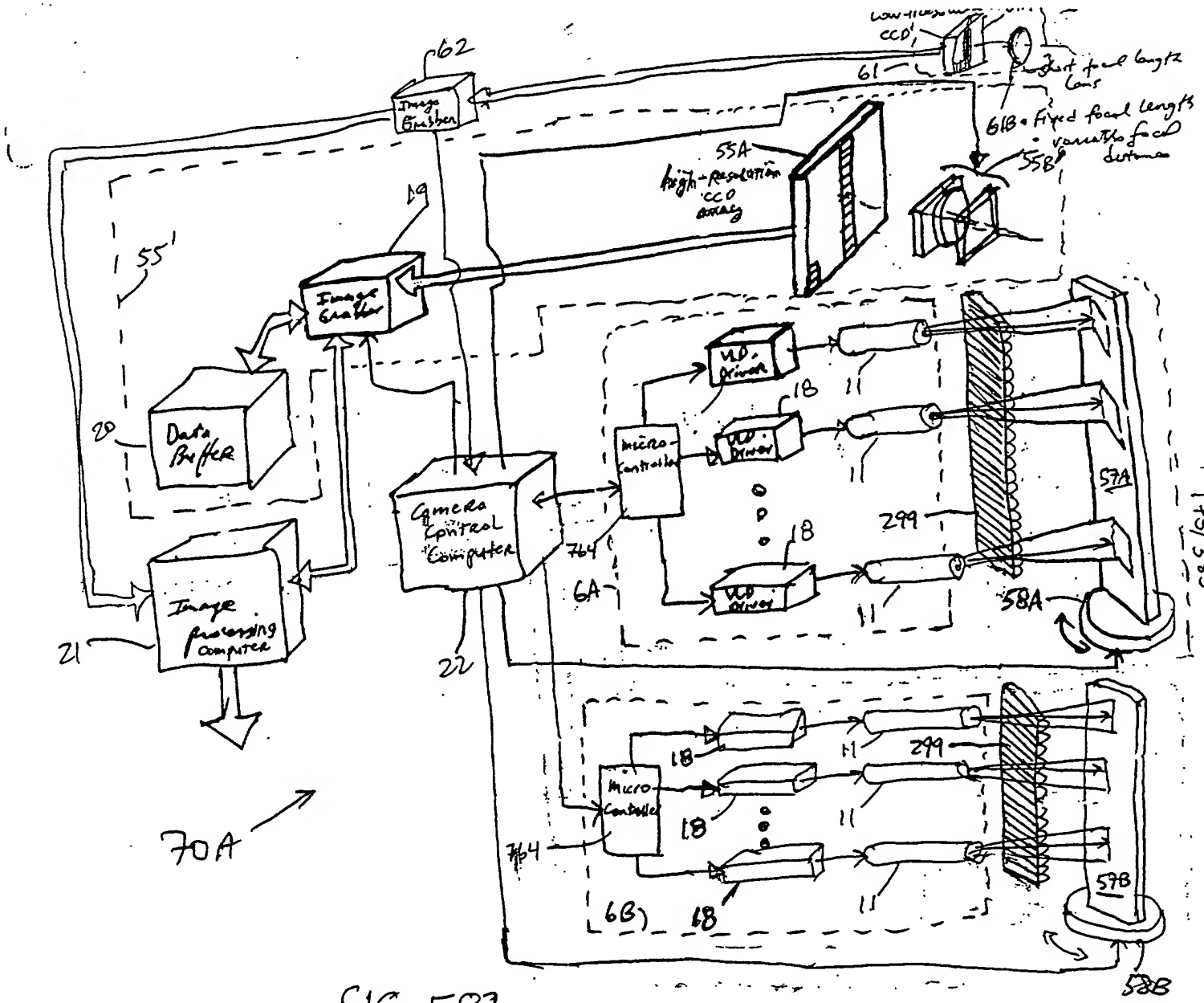

62
61
CCD
55A
High-Resolution CCD array
55B
55'
19
Image Grabber
20
Data Buffer
Camera Control Computer
Micro-controller
V.D. Driver
CCD Driver
18
299
57A
58A
64
6A
11
21
Image processing Computer
22
70A
6B
57B
58B
175/385

FIG. 5B3

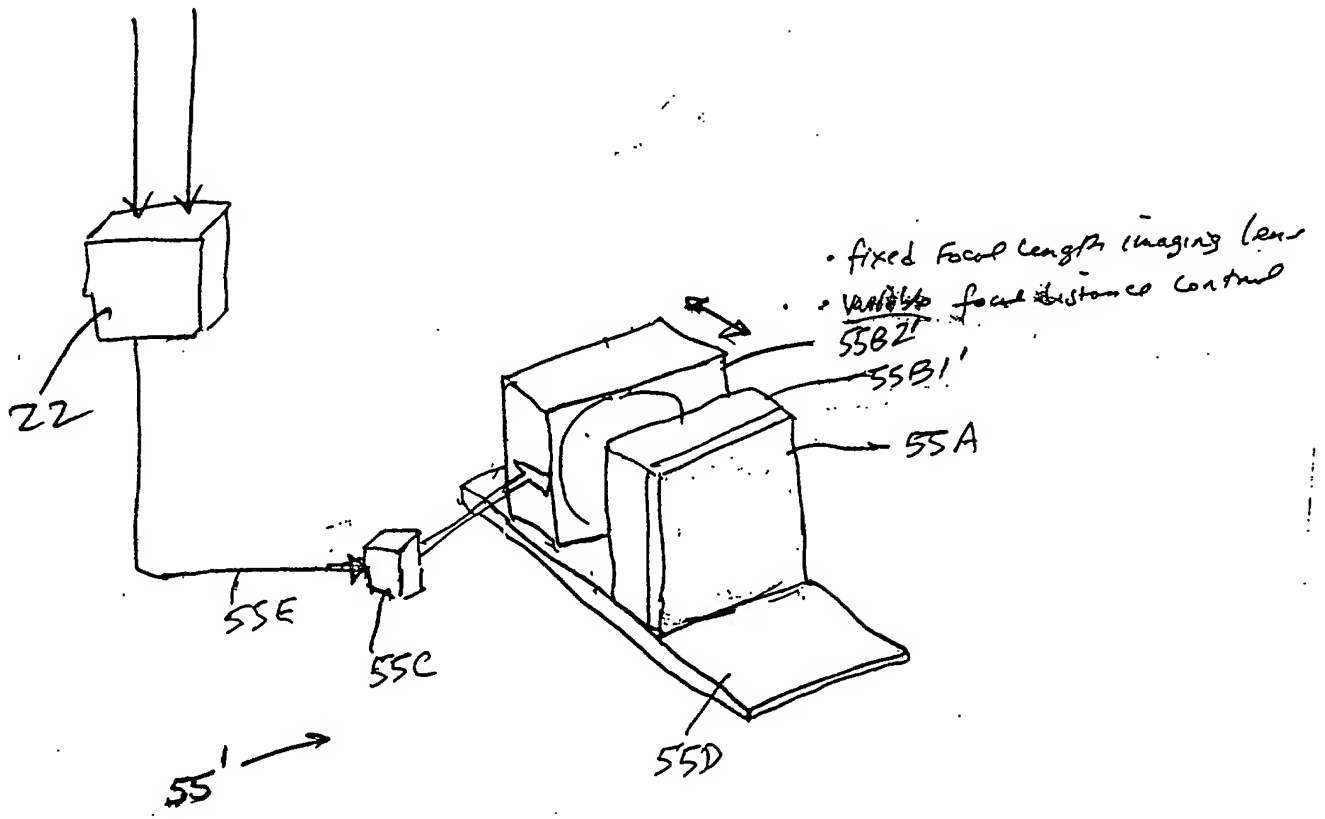


FIG. 5B4

4100649527.0227702

177/385

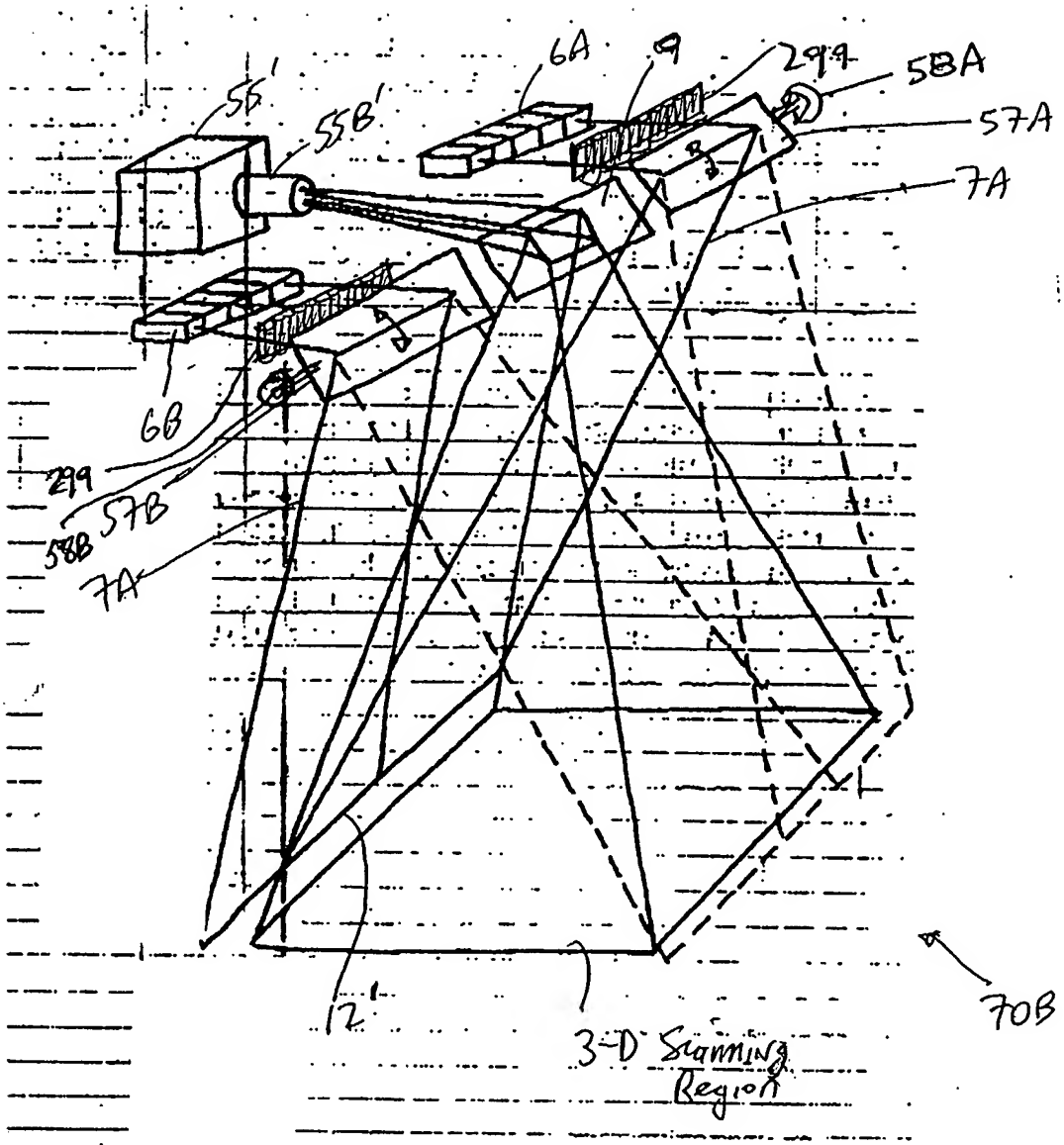


FIG. 5C1

(1) variable focal length zoom lens
(2) Fixed focal distance

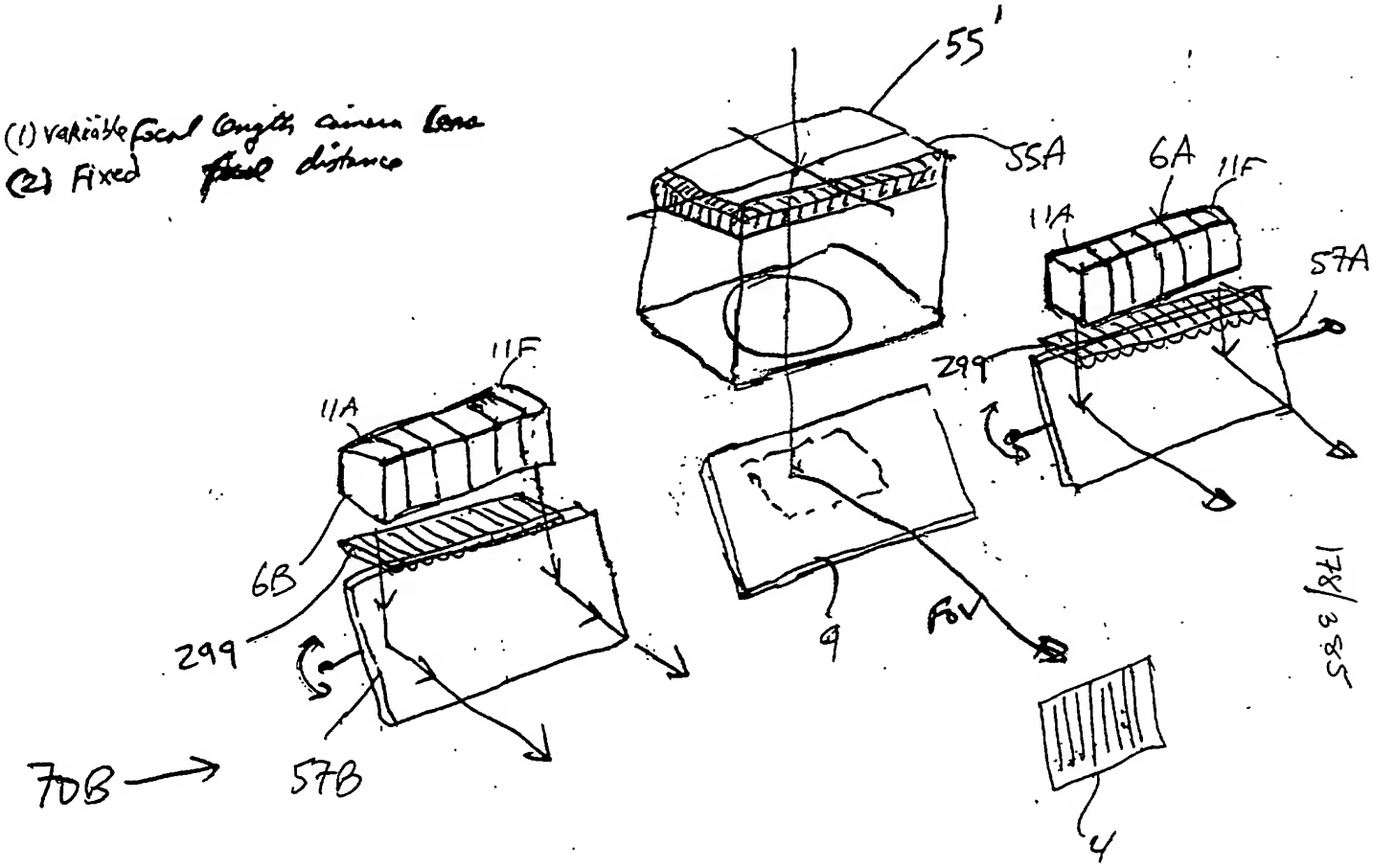


FIG. 5C

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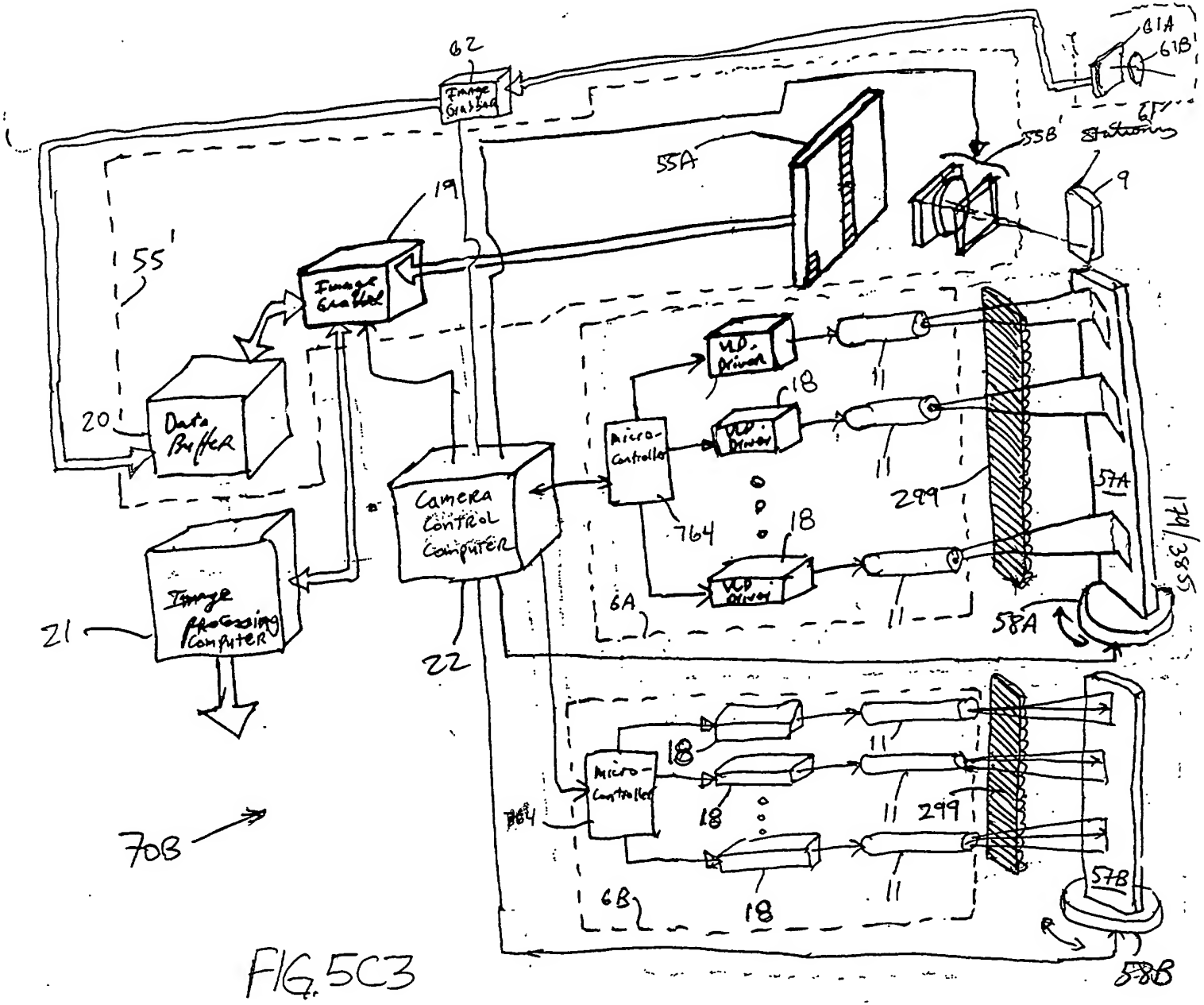

FIG. 5C3

124/385

4008492 .022702

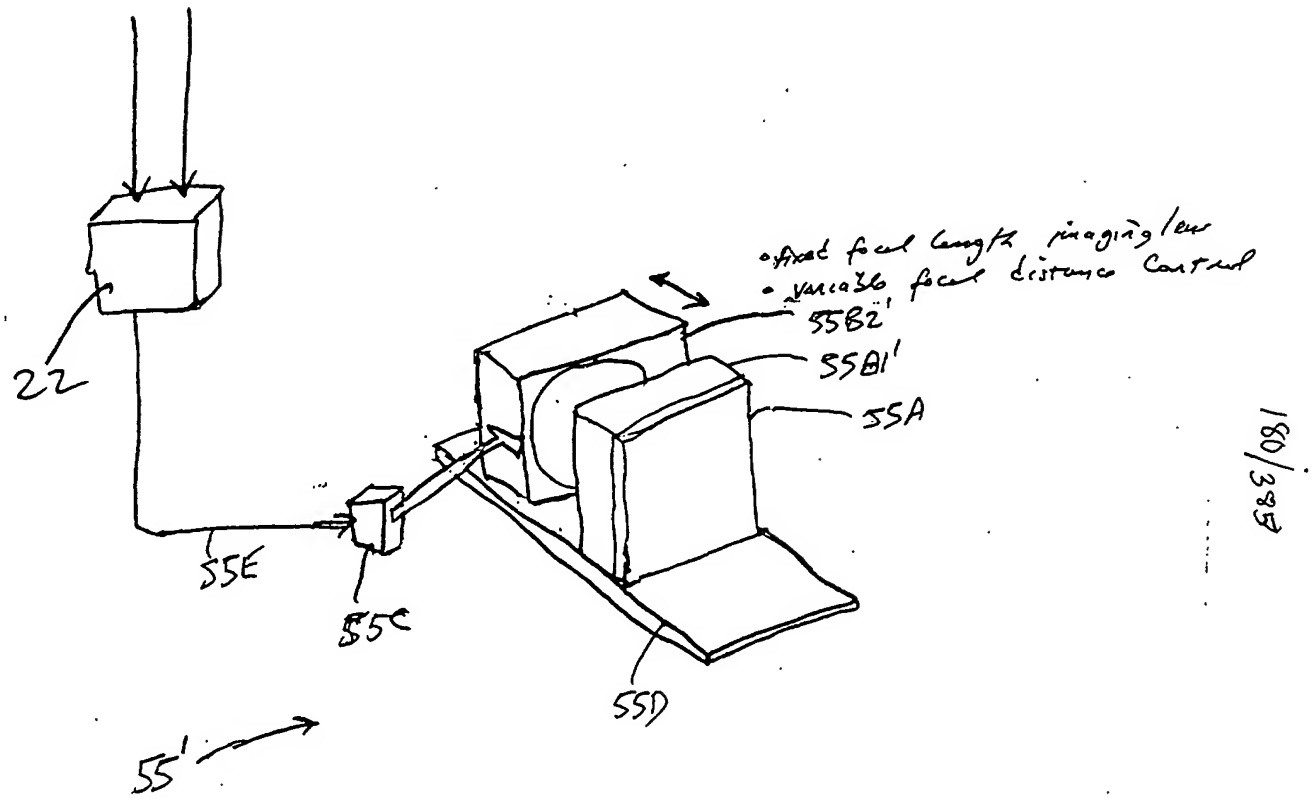

FIG. 5C4

180/383

EP 2 722 690 A2 23-04-2014

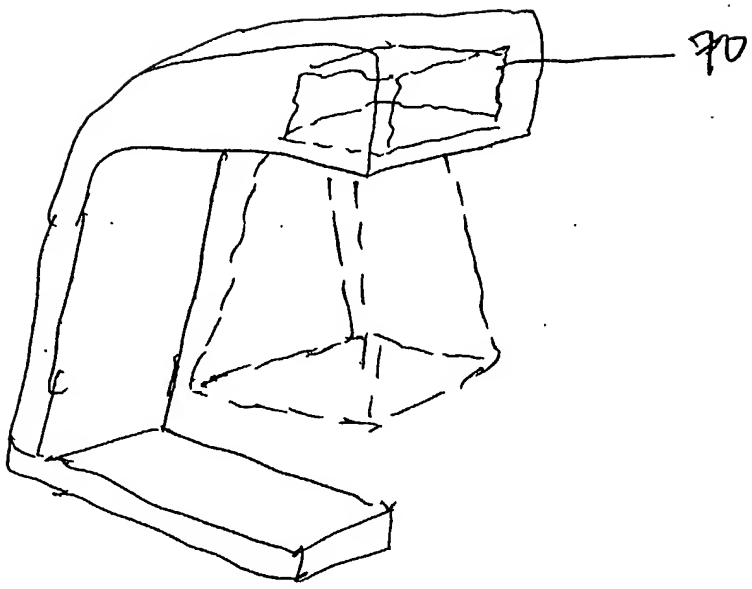

FIG. 5D

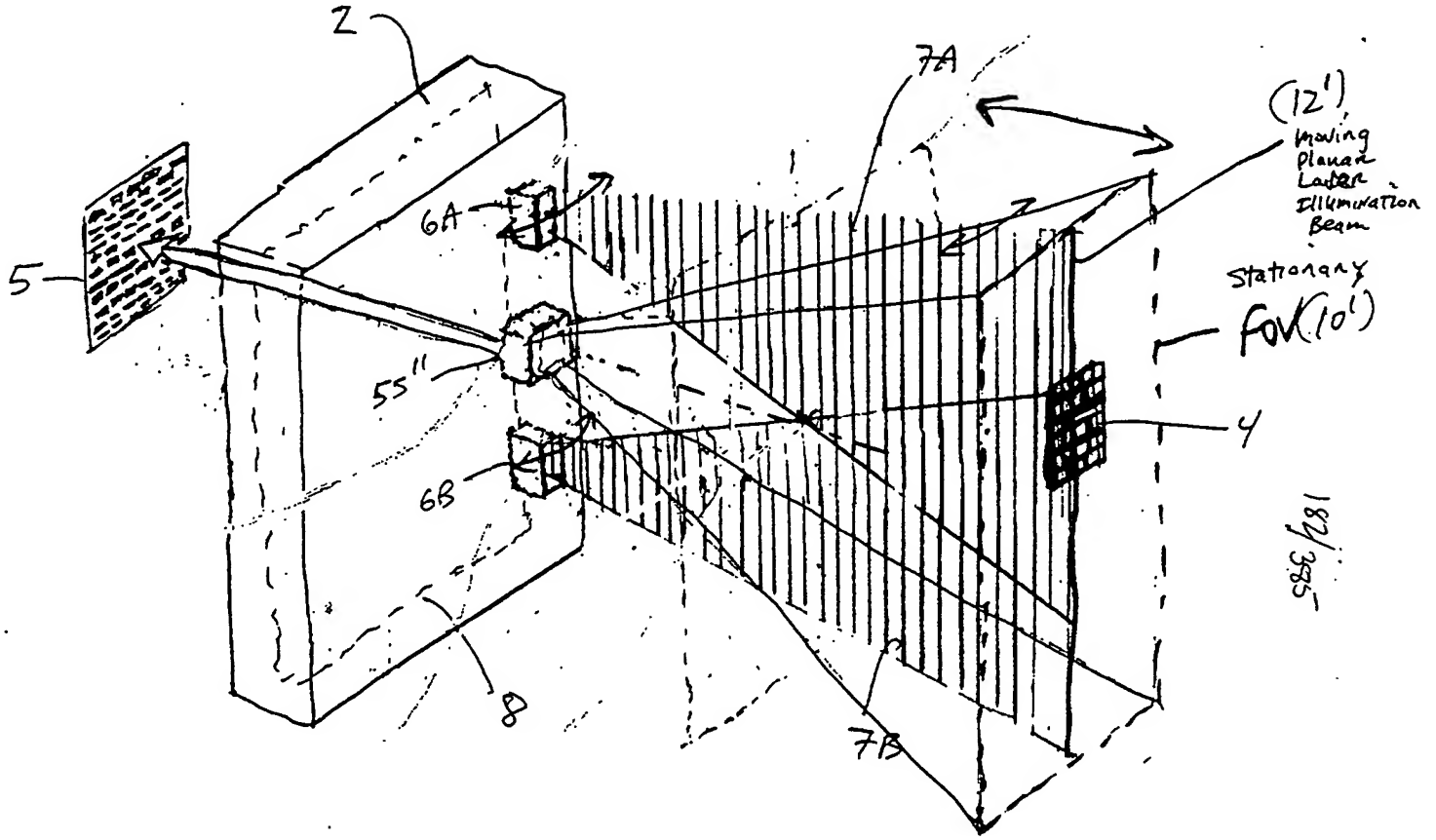
2
7A
(12')
Moving
Planar
Laser
Illumination
Beam
Stationary
FOV(10')
6A
5
55"
4
6B
8
7B
80

FIG. 6A

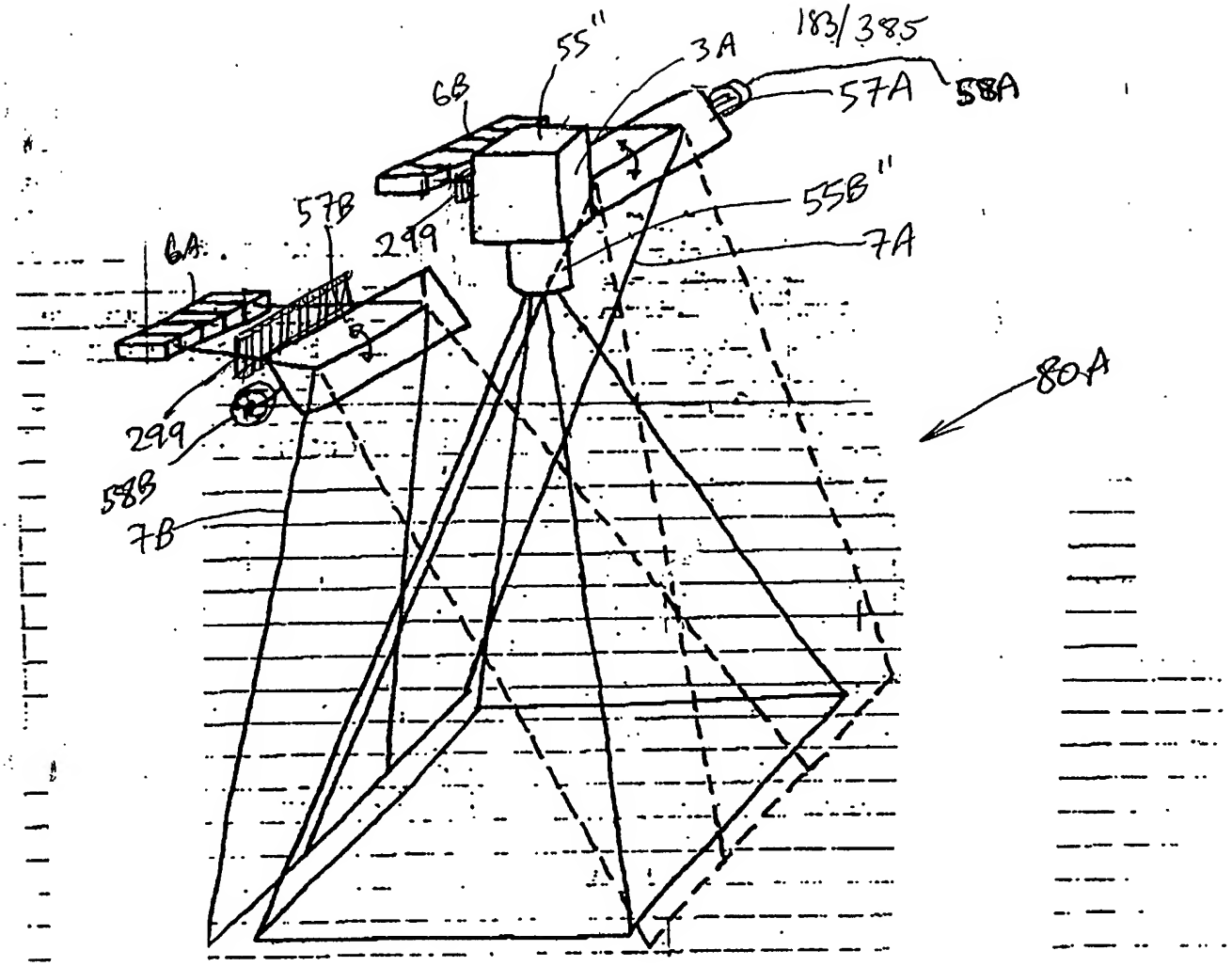

FIG. 6B1

(1) variable focal length camera lens
(2) variable focal distance

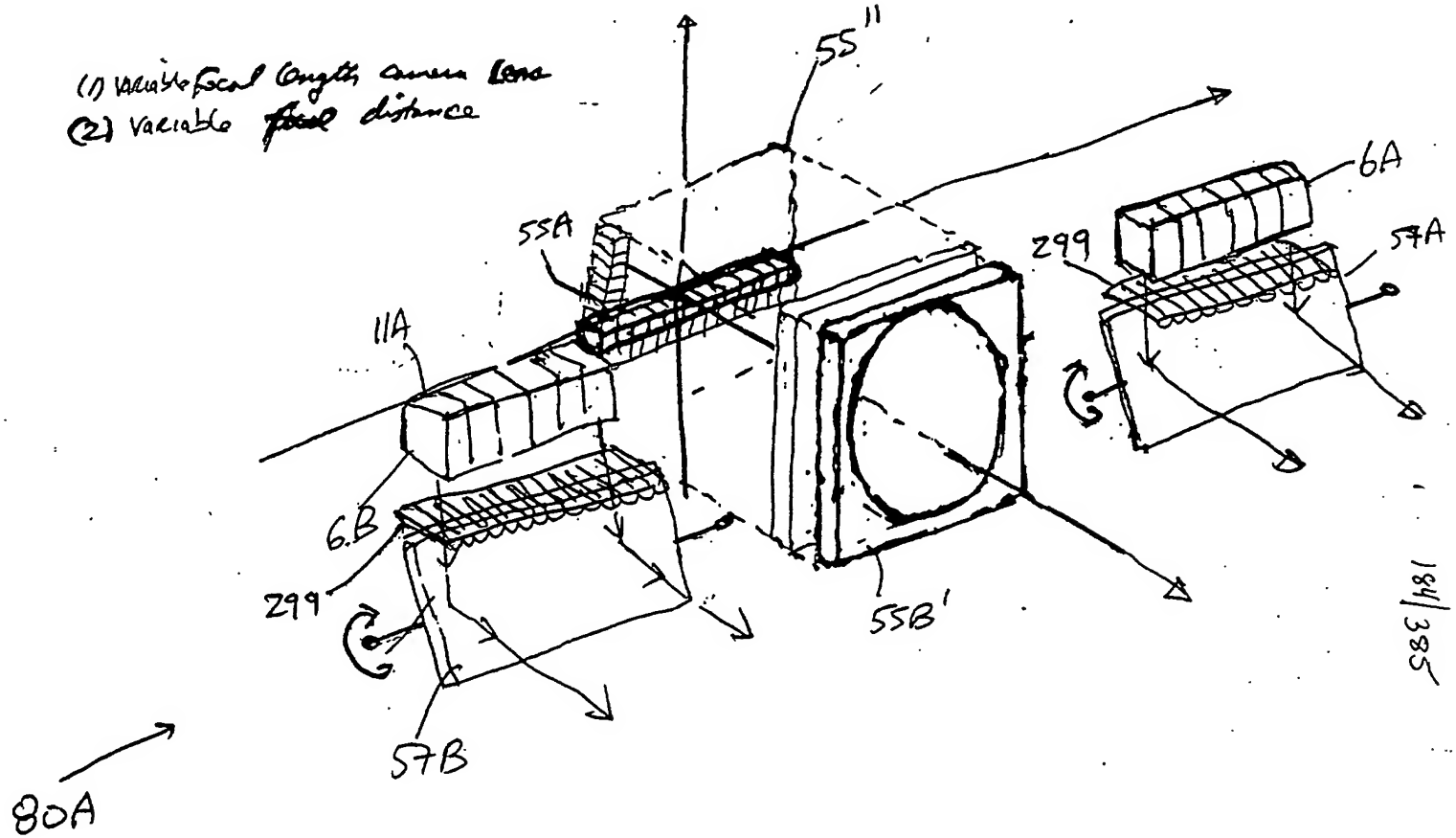

FIG. 6B2

20220260 - 2022-08-11

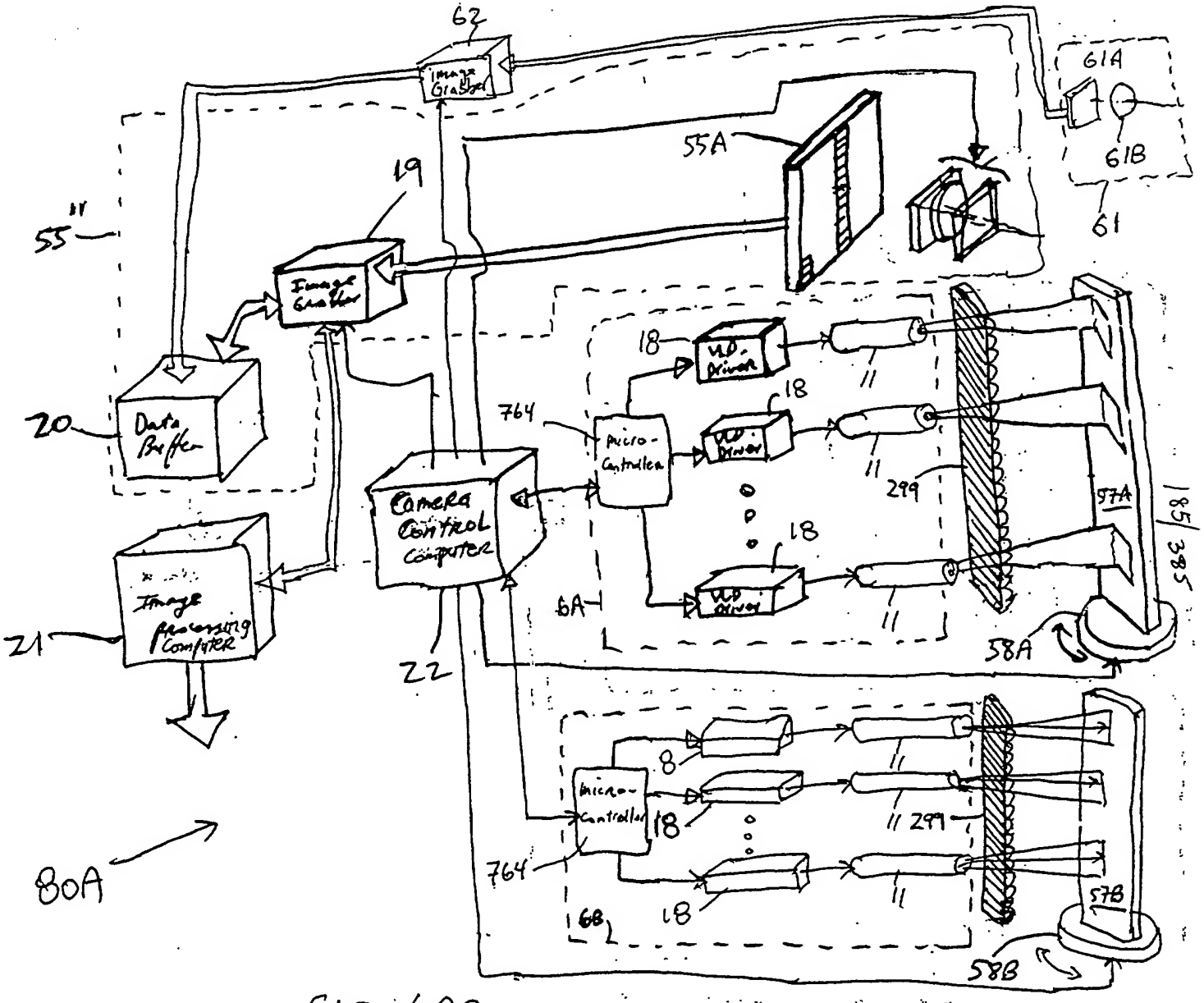
62
Image Grabber
61A
61B
61
55A
19
55
Image Grabber
20
Data Buffer
21
Image Processing Computer
Camera Control Computer
22
764
Micro-Controller
18
VLD Driver
299
57A
185/385
6A
58A
8
57B
6B
58B
80A

FIG. 6B3

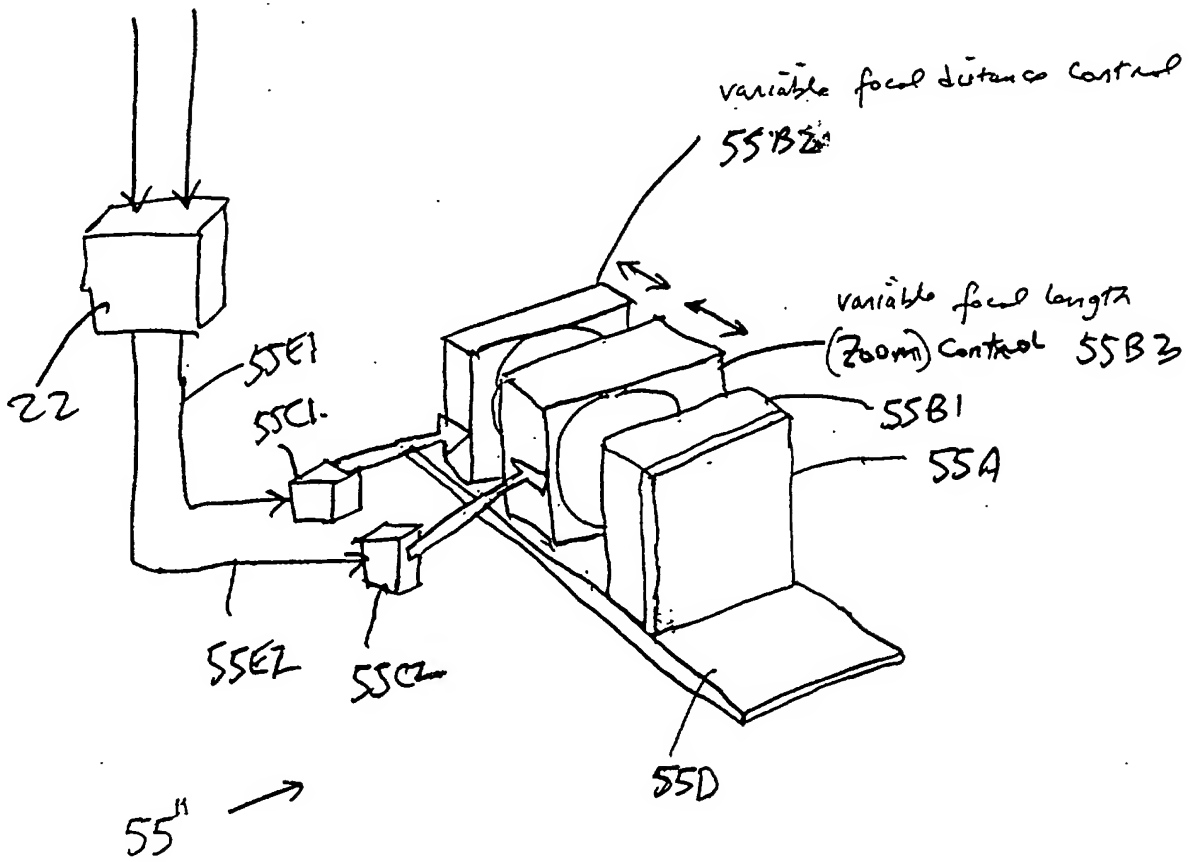

FIG. 6B4

SBC/981

2005/2020 "2005/2020

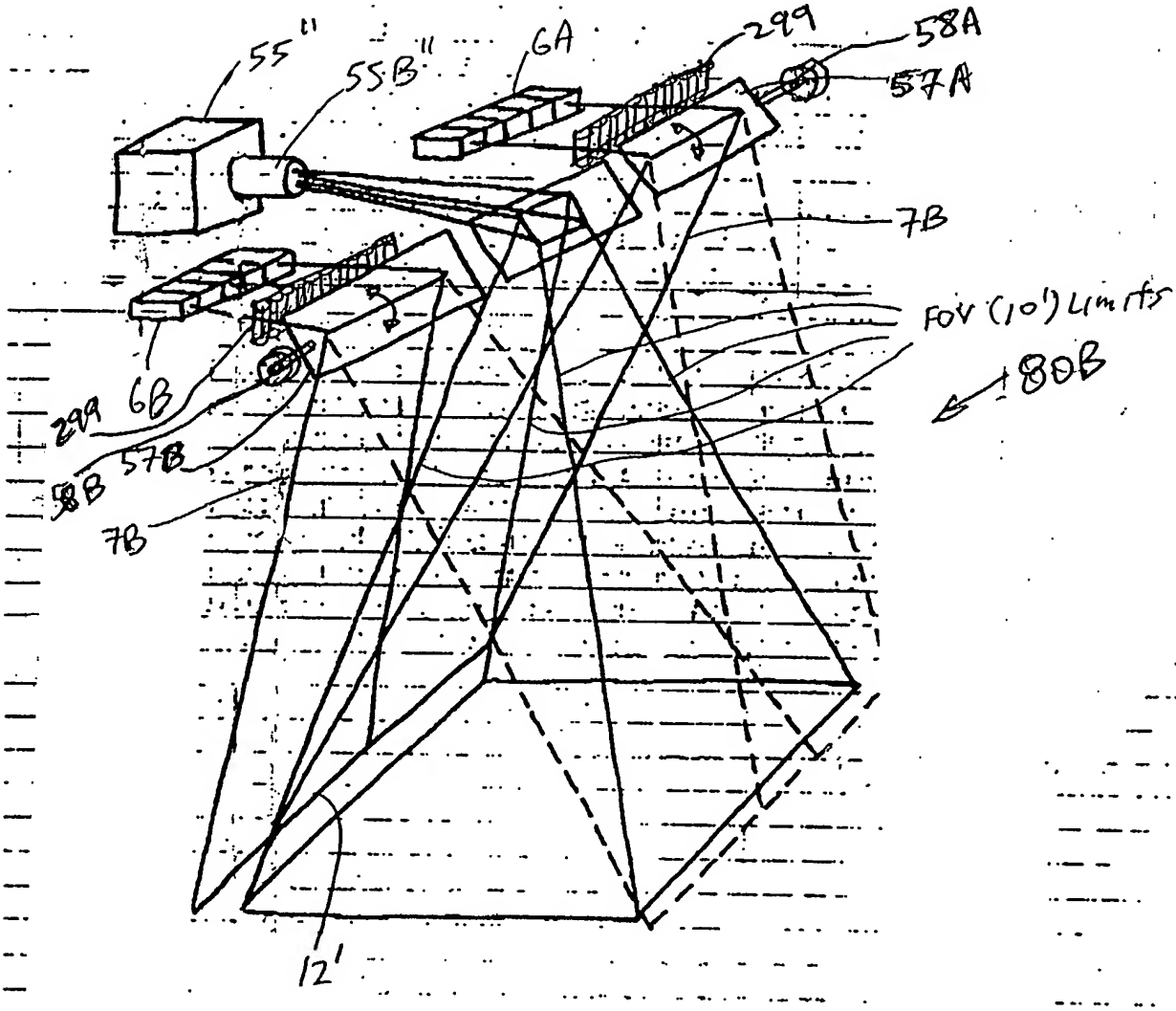

FIG. 6C1

(1) variable focal length camera lens
(2) variable ~~focal~~ distance

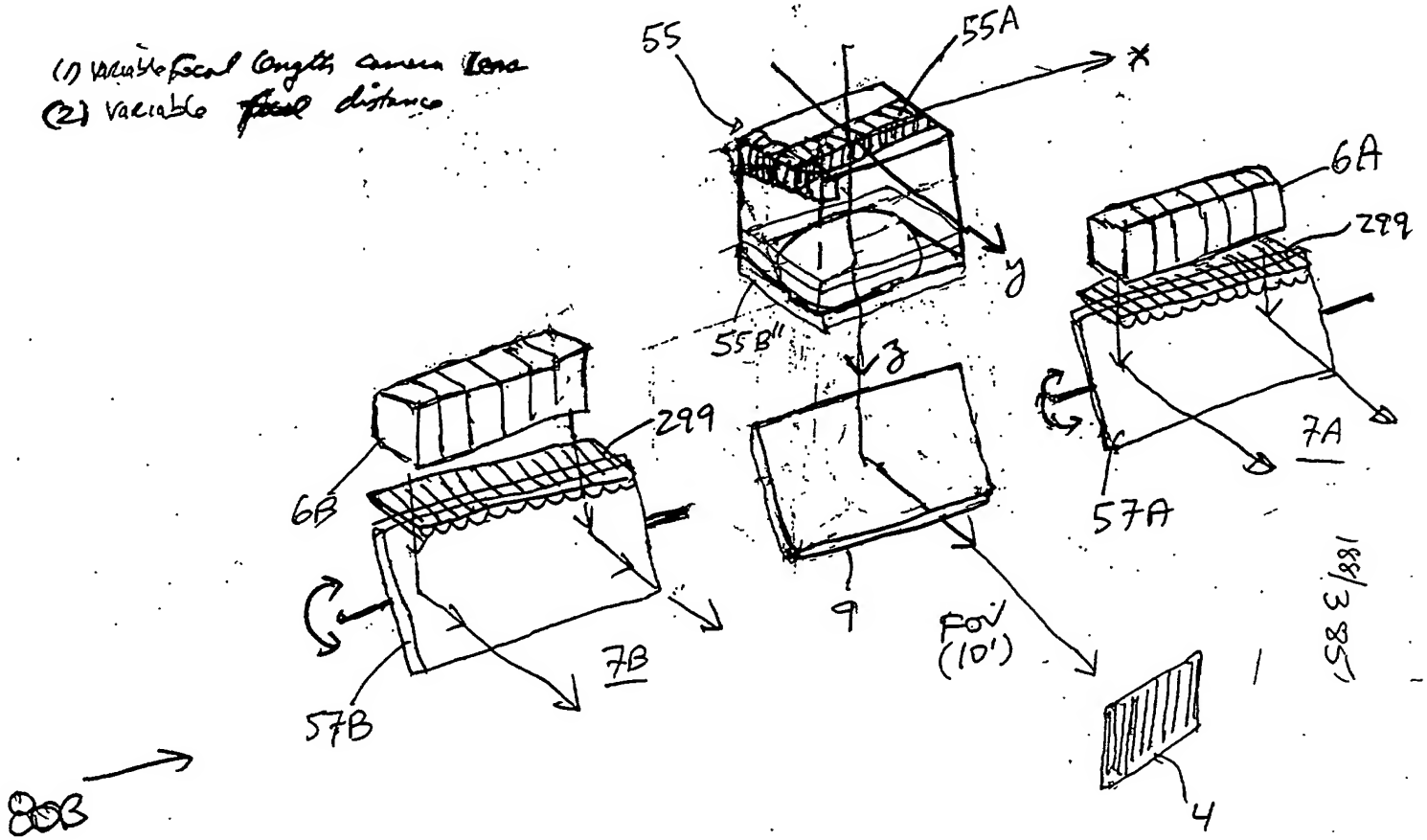

FIG. 6C2

EP 2 782 049 A2 20140924

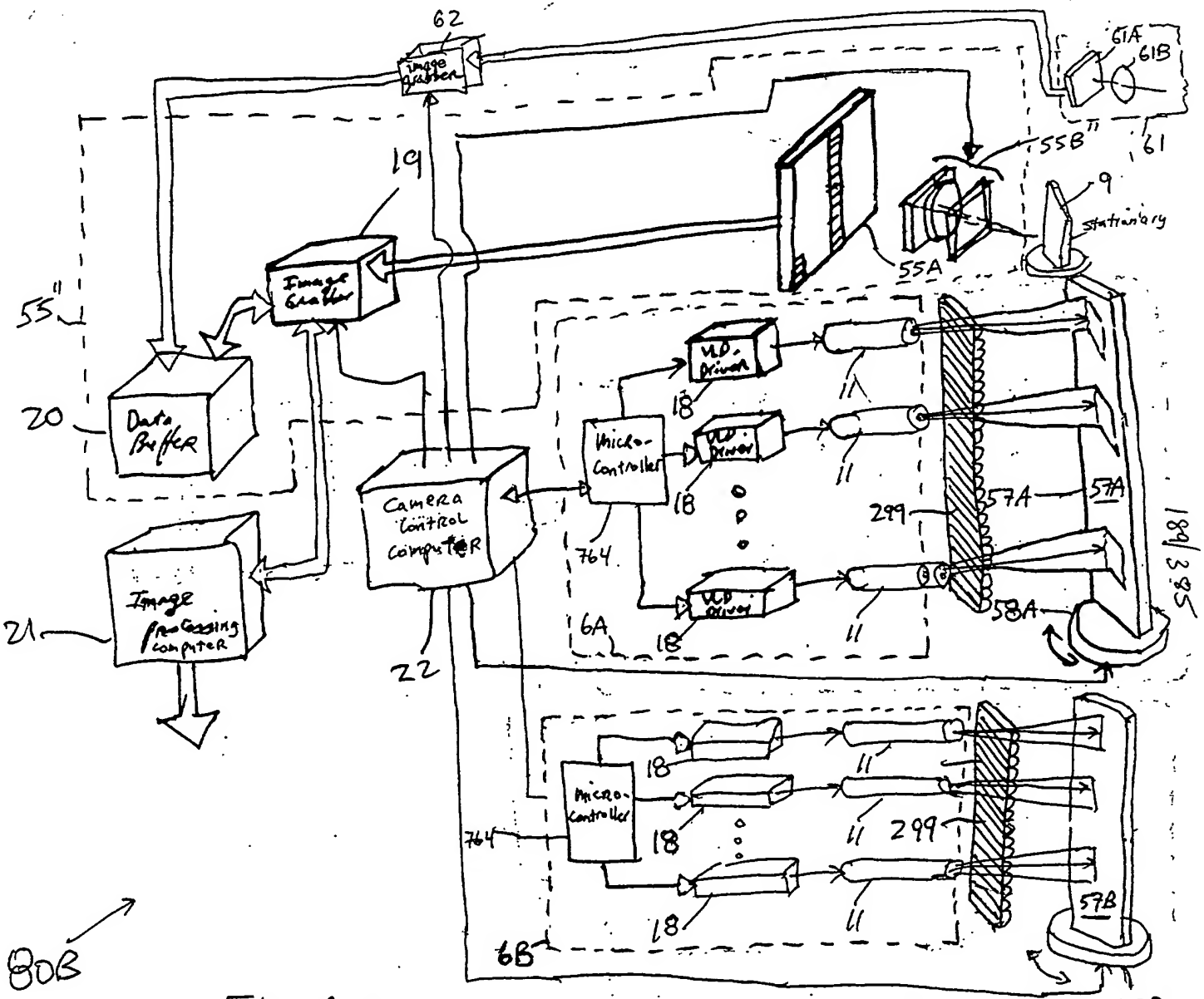
62
Image Grabber
61A
61B
61
55B"
9
stationary
55A
19
Image Grabber
55"
20
Data Buffer
VLD Driver
18
Micro-Controller
Camera Control Computer
764
299
57A
189/385
58A
6A
21
Image Processing Computer
22
Micro-Controller
764
299
57B
6B
58B
80B

FIG. 6C3

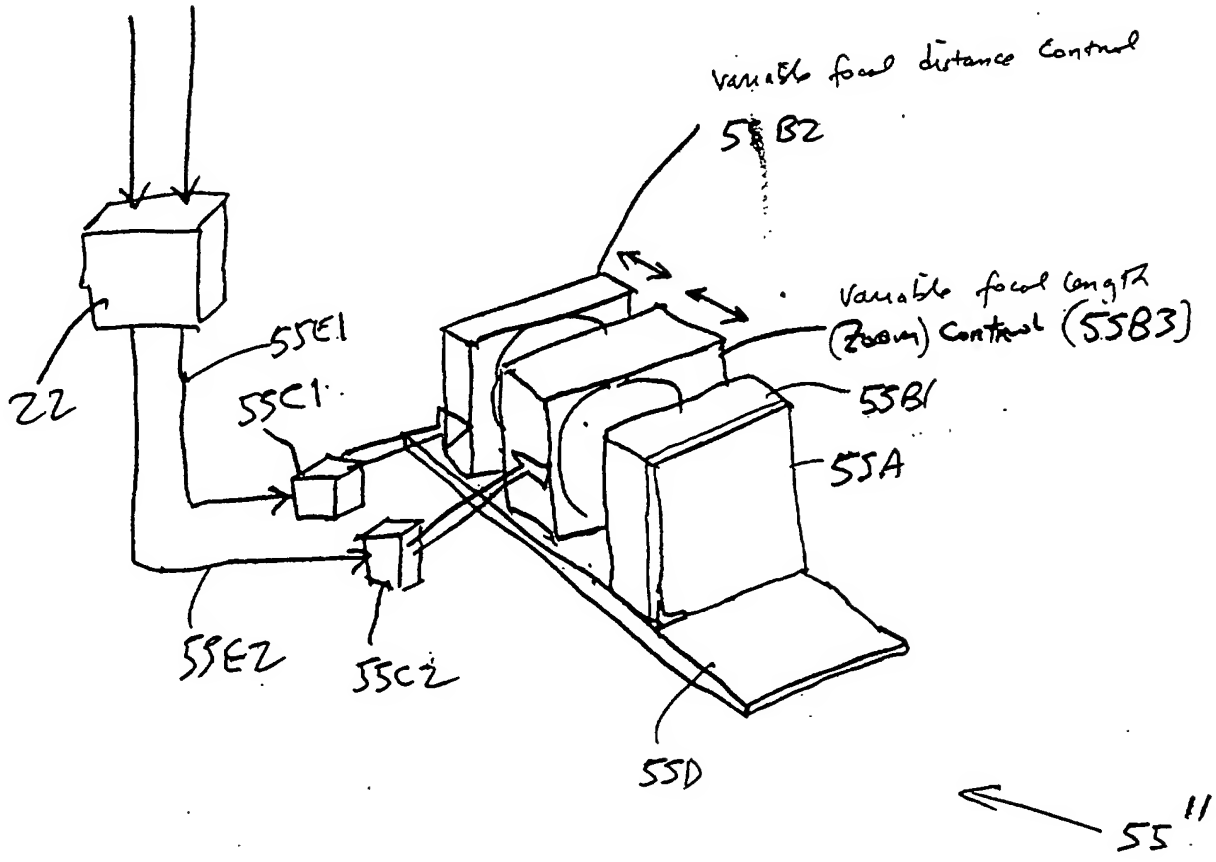

FIG. 6C4

20220207 4288480 1900385

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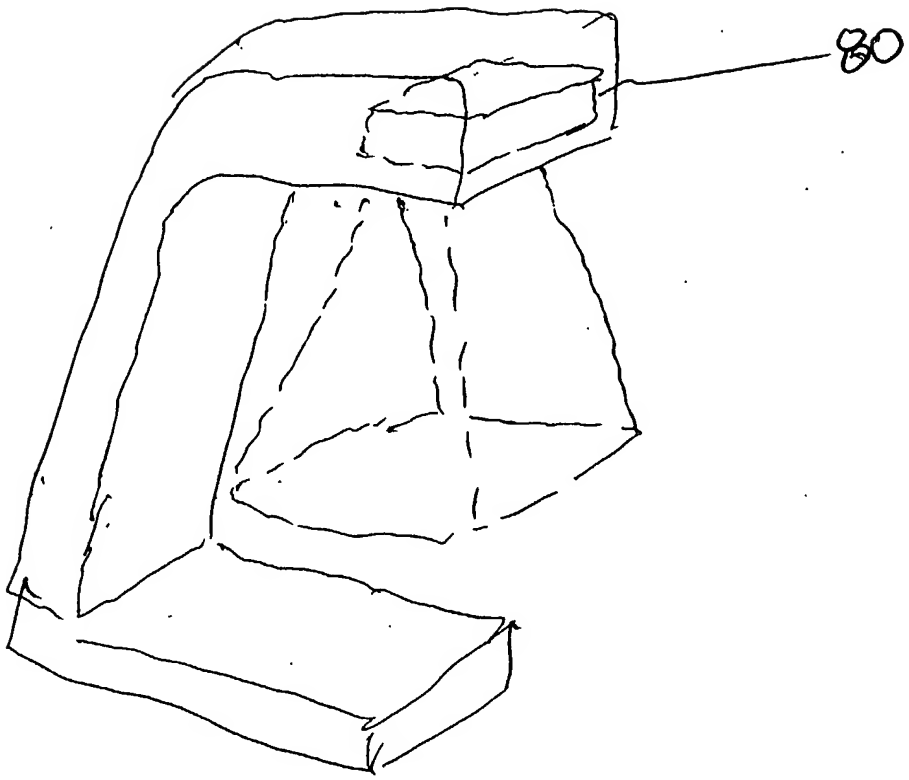

FIG. 6C5

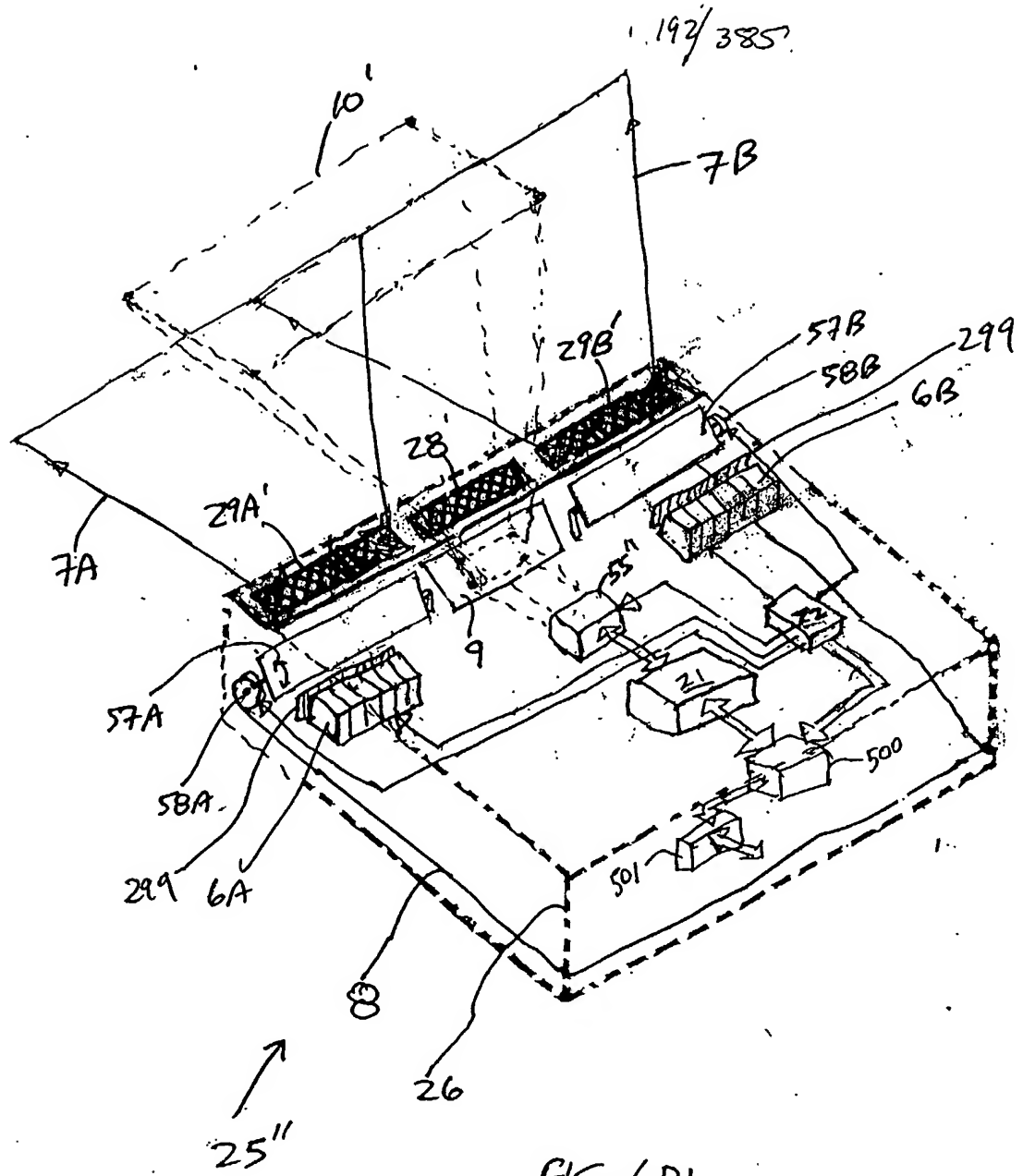
192/385
10'
7B
29B'
57B
299
58B
6B
28
29A'
7A
55
9
57A
21
500
58A
299
6A
501
8
26
25''

FIG. 6D1

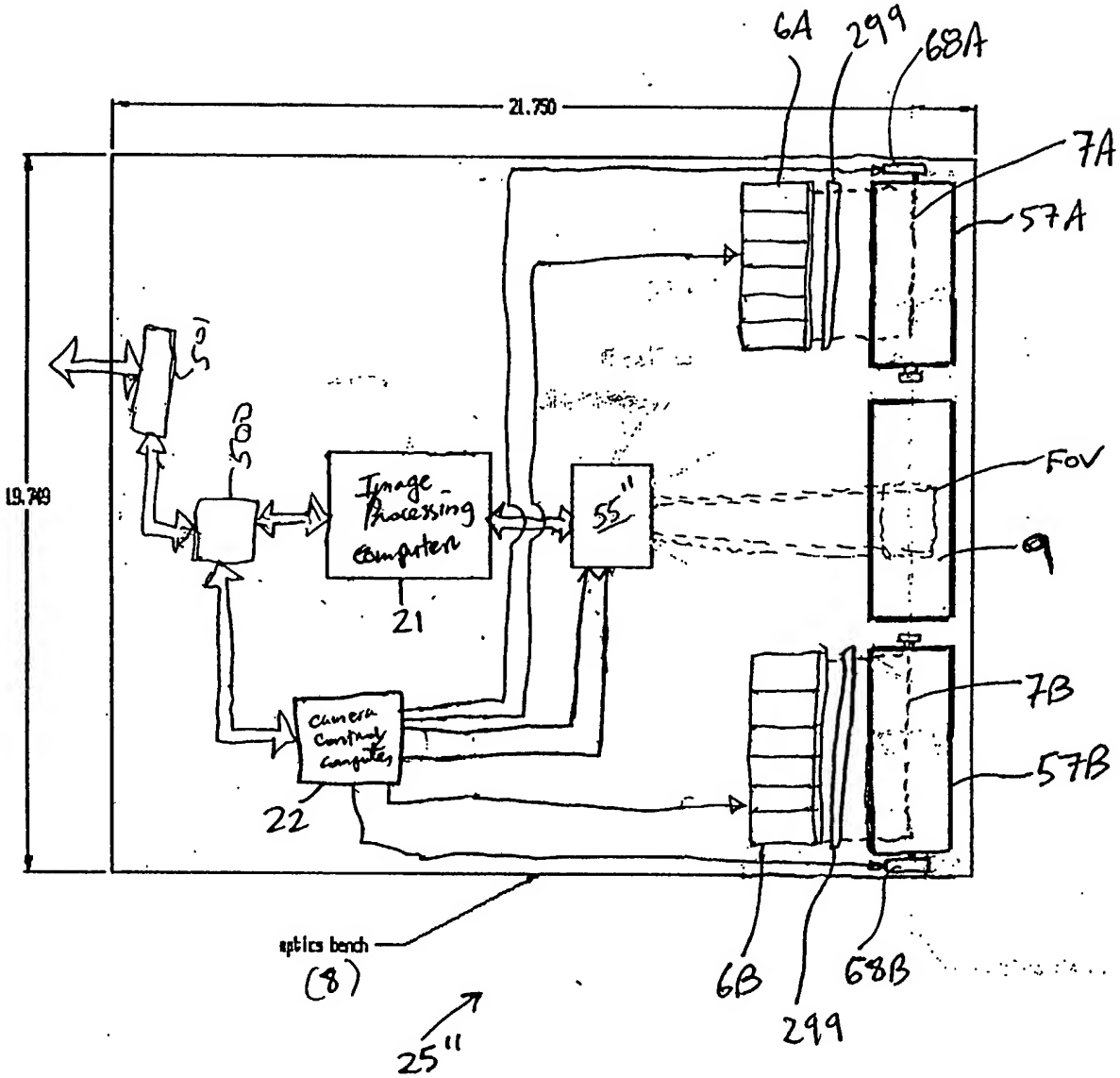
6A
299
68A
21.750
7A
57A
19.749
50
Image Processing computer
55"
FoV
9
21
7B
57B
camera control computer
22
optics bench
(8)
6B
68B
299
25"

FIG. 6D2

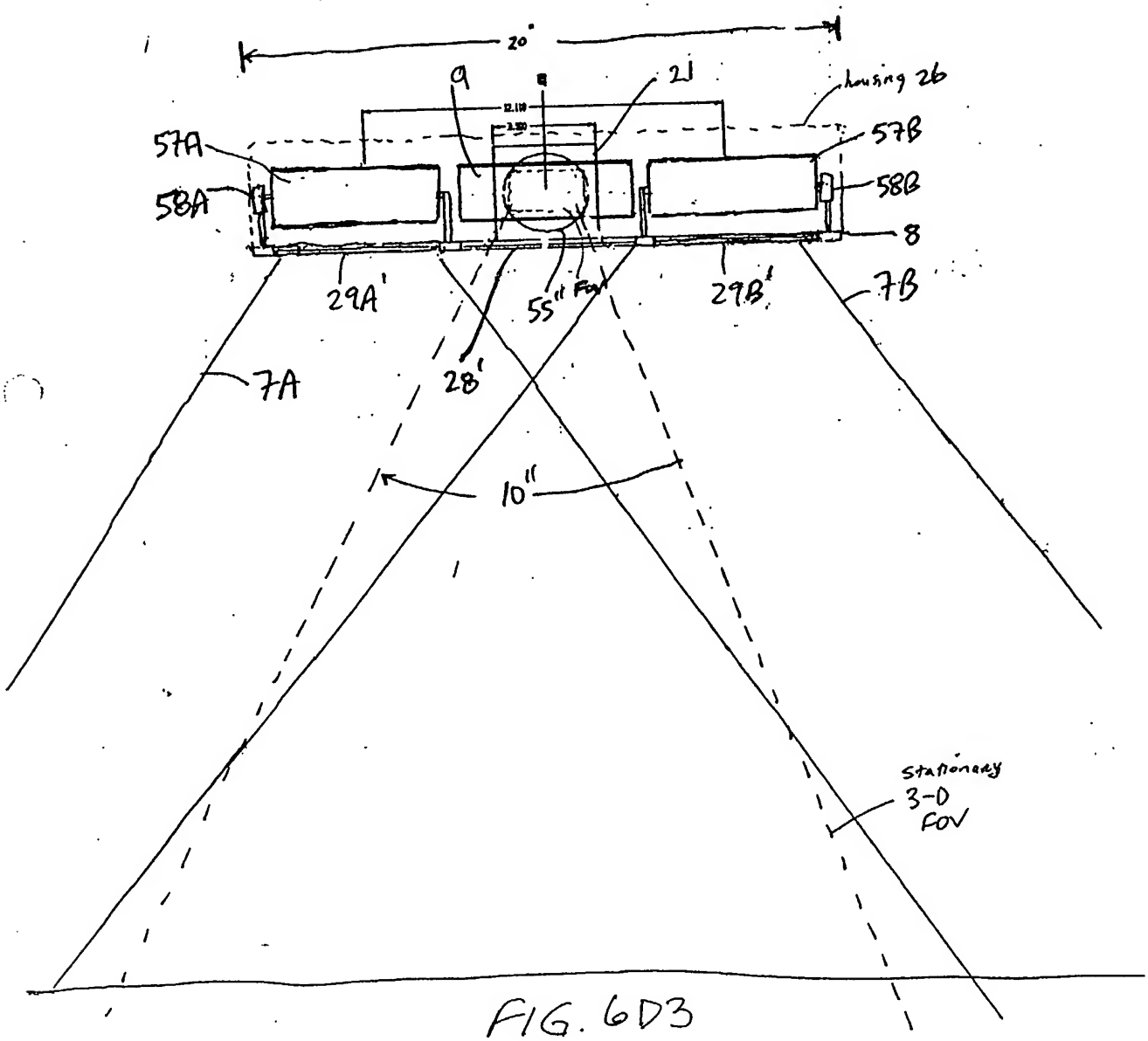
20"
9
21
housing 26
57A
57B
58A
58B
8
29A'
55" FOV
29B'
7B
7A
28'
10"
stationary
3-D
FOV

FIG. 6D3

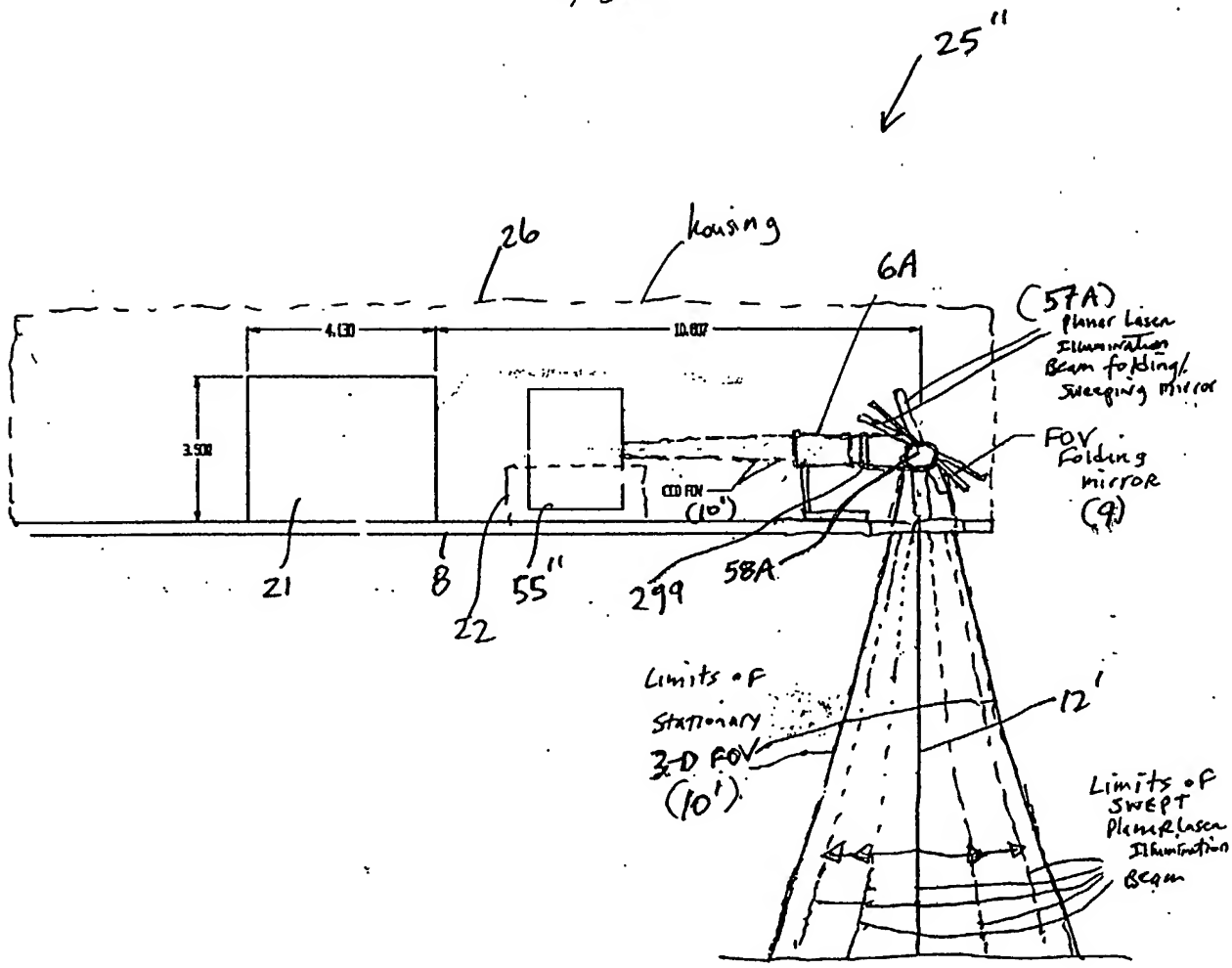
25"
26
housing
6A
(57A)
Planar Laser Illumination Beam folding/ sweeping Mirror
FOV Folding mirror (9)
4.130
10.607
3.500
CCD FOV (10')
21
8
22
55"
299
58A
Limits of Stationary 3-D FOV (10')
12'
Limits of SWEPT Planar Laser Illumination Beam

FIG. 6D4

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variable FOV

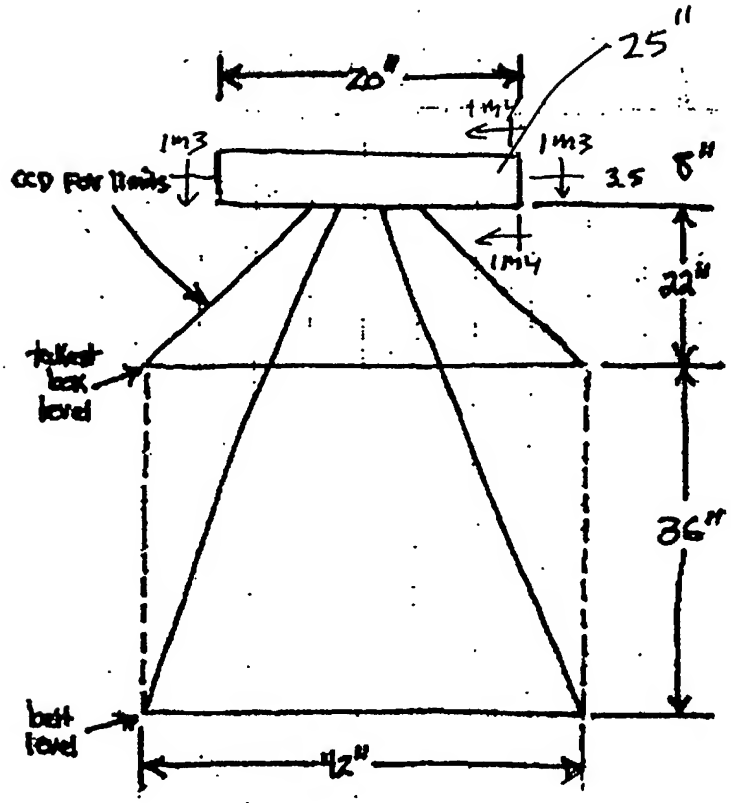

FIG. 6D5

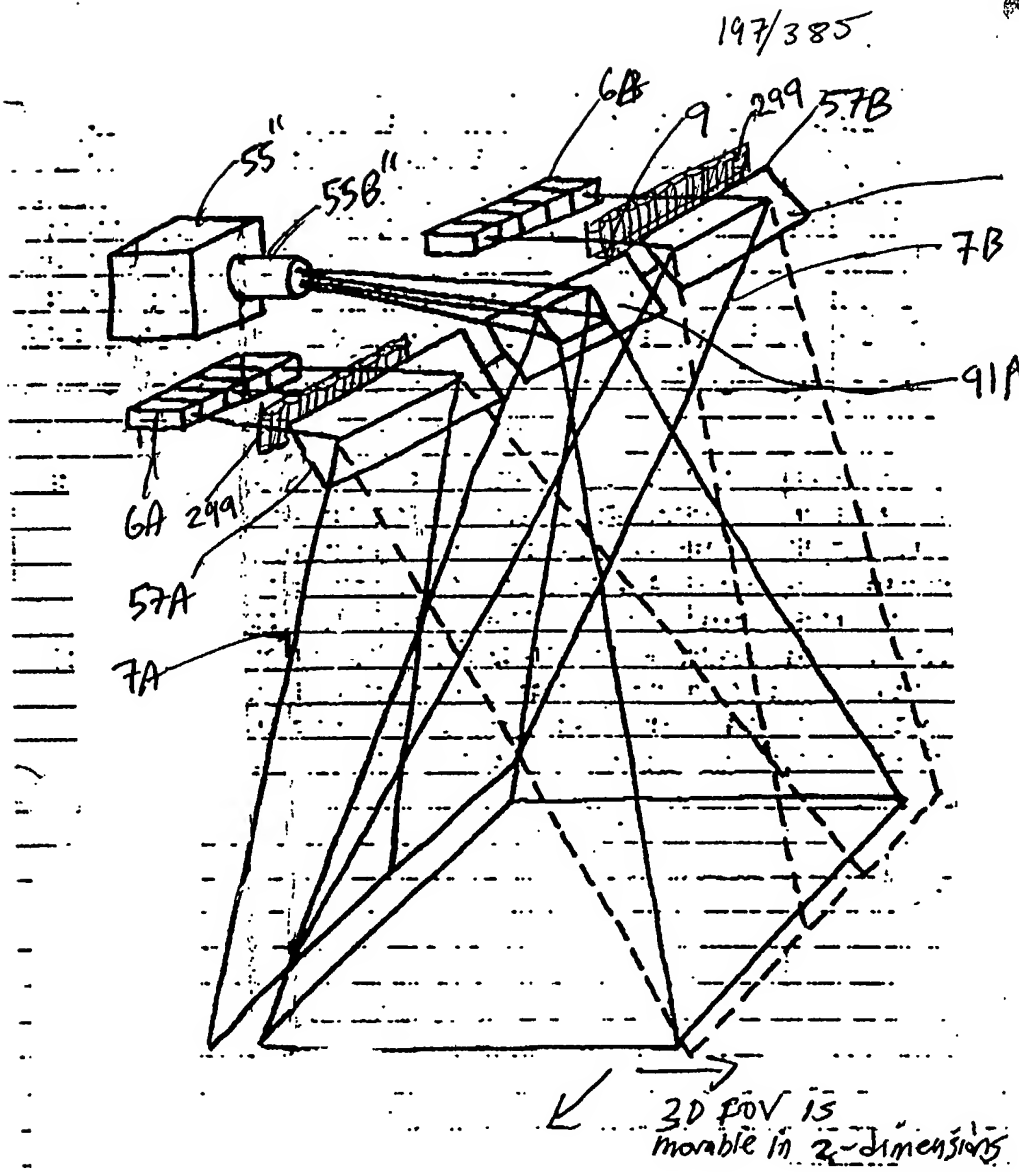
197/385
6B
9
299
57B
55"
55B"
7B
91A
90
6A
299
57A
7A
3D FOV is
movable in 2-dimensions

FIG. 6E1

(1) variable focal length camera lens
(2) variable focal distance

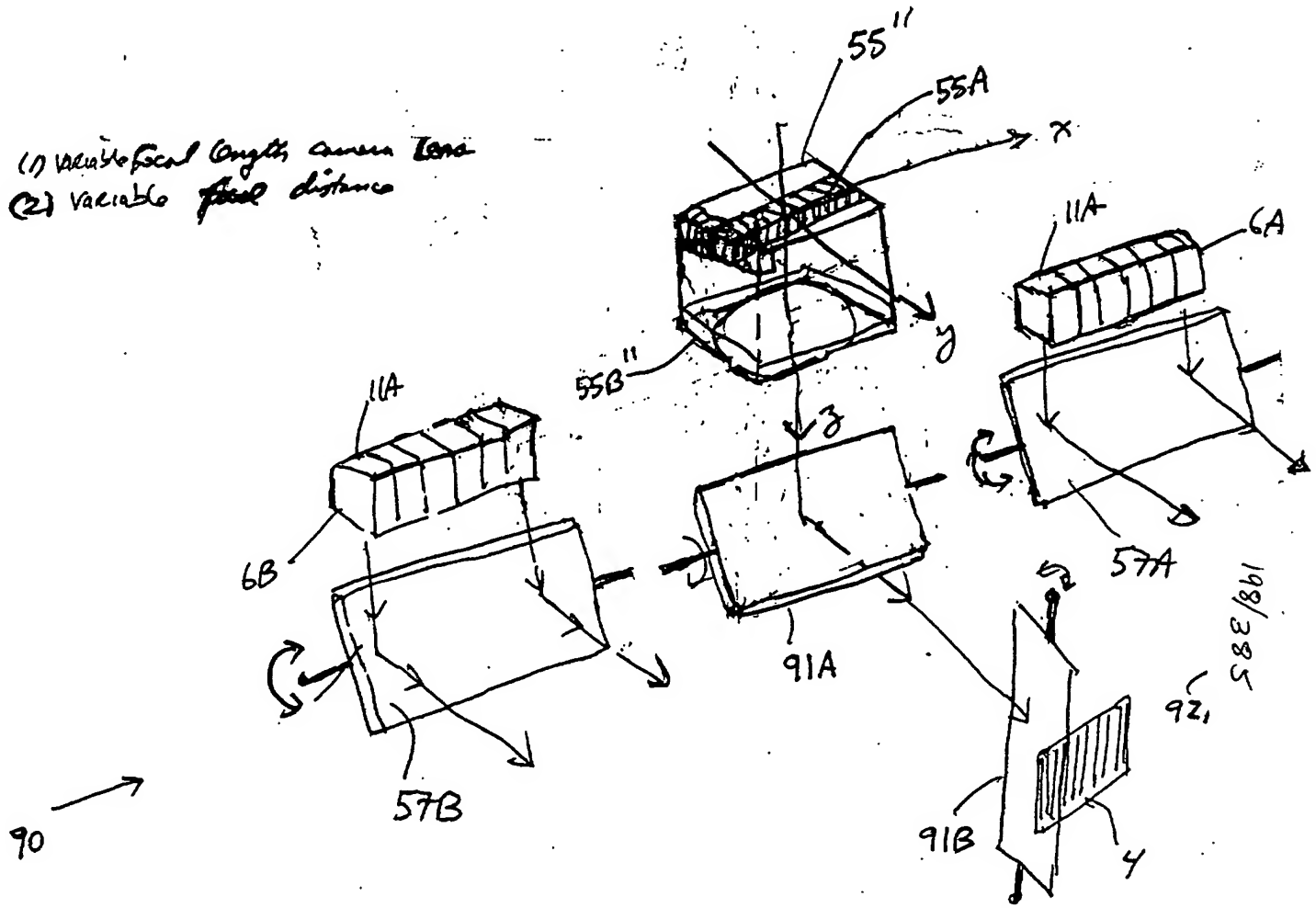

FIG. 6E2

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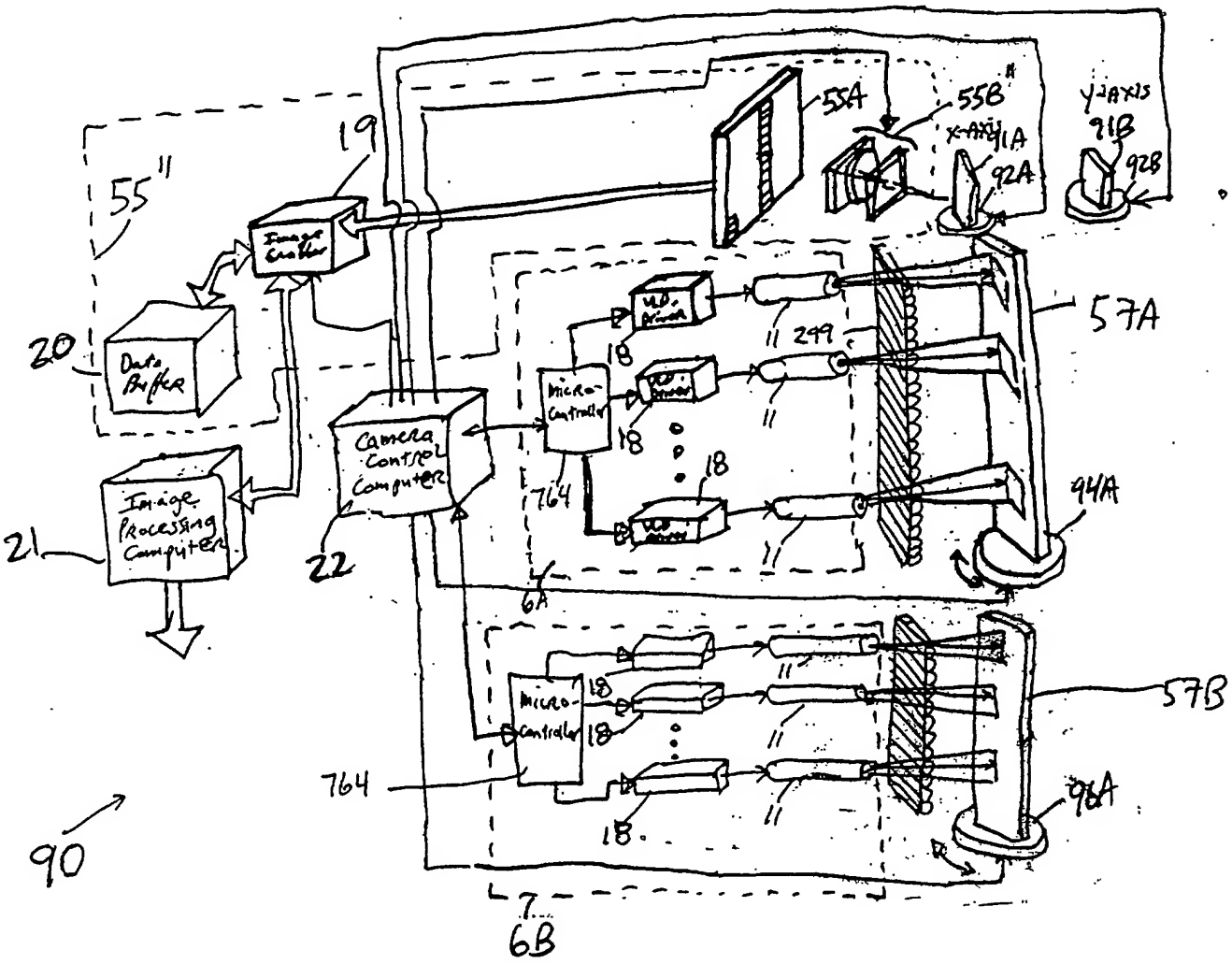

FIG. 6E3

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10084427 - 022702

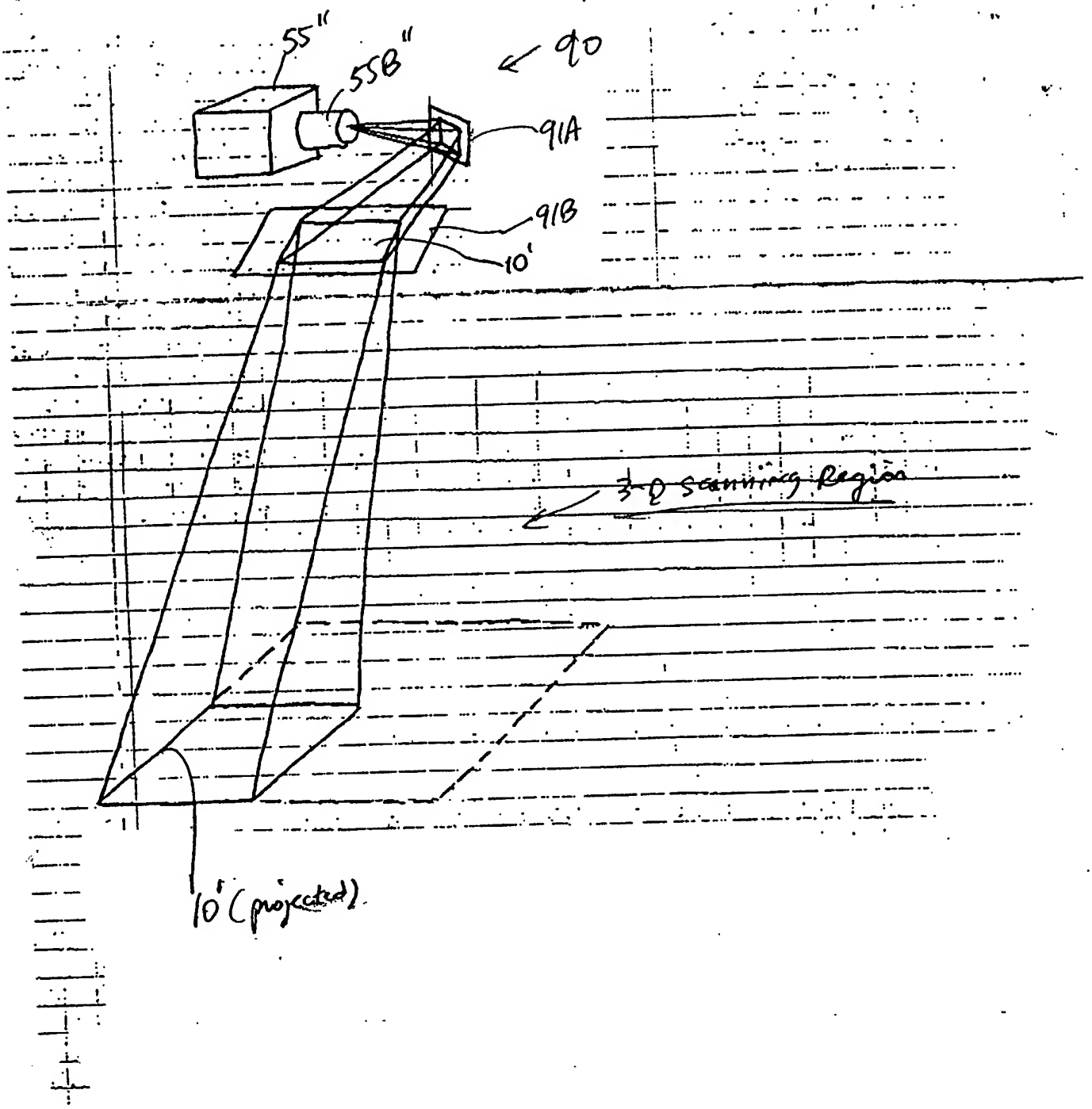

FIG. 6E4

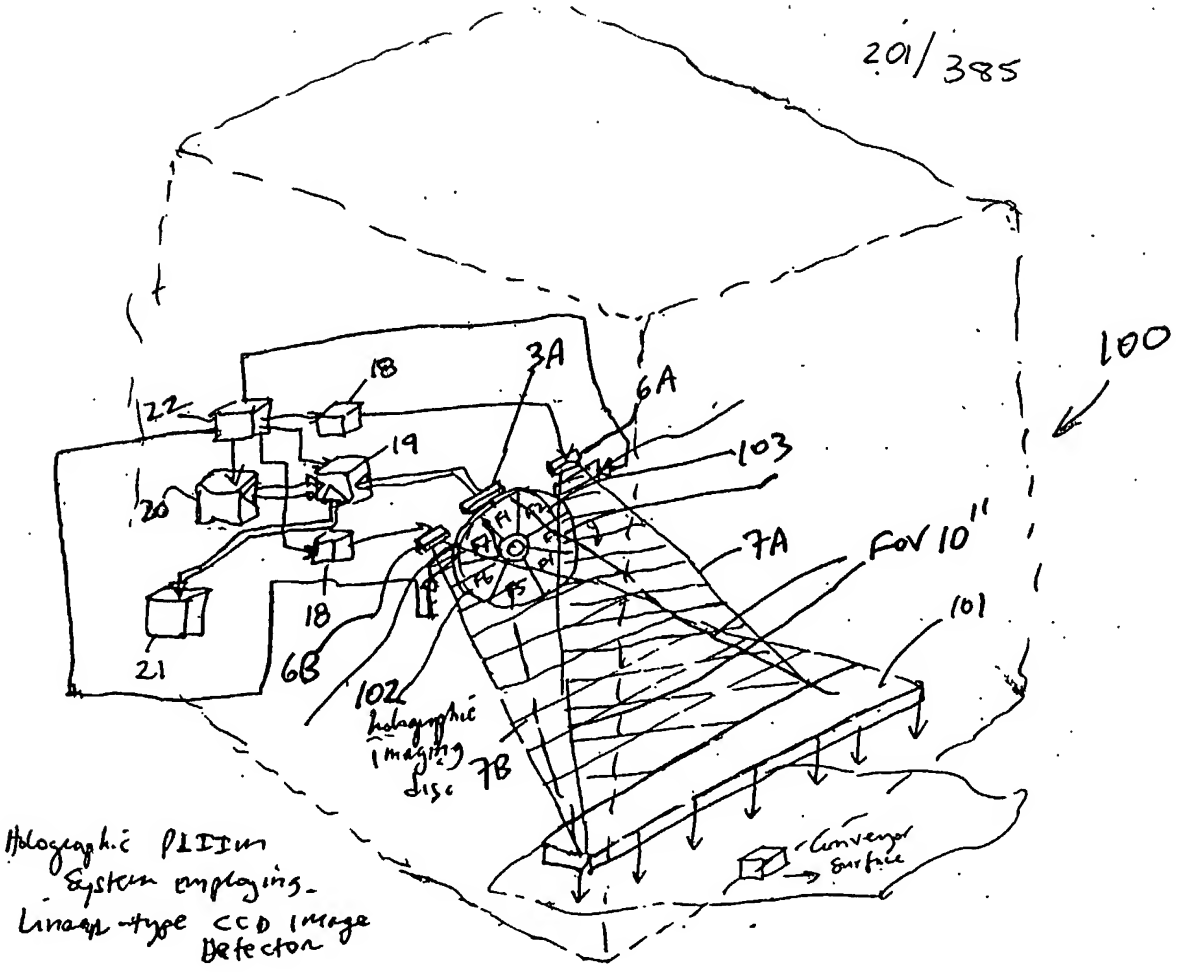
201/385
100
1B
3A
6A
22
19
103
20
7A
FoV 10"
18
101
21
6B
102
holographic imaging disc
7B
Holographic PLIIM System employing Linear-type CCD Image Detector
Conveyor surface

FIG. 7A

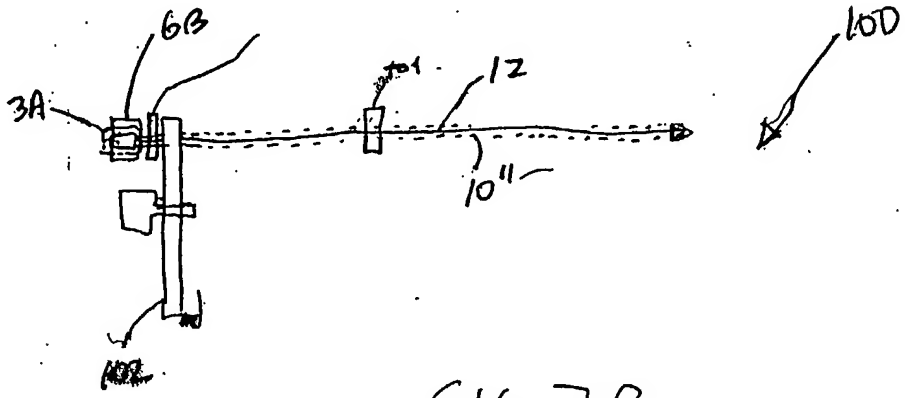
6B
100
3A
12
10"
102

FIG. 7B

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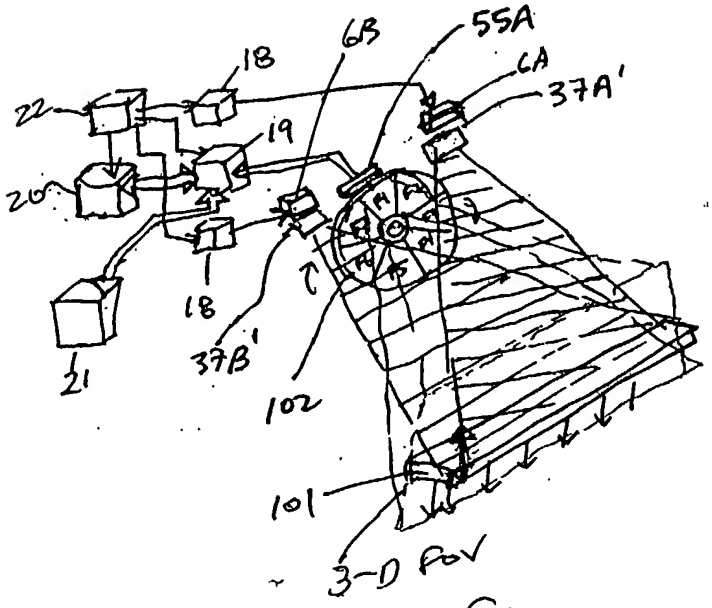

Holographic PLIIM System employing Area-Type CCD Image Detector

100'

FIG. 8A

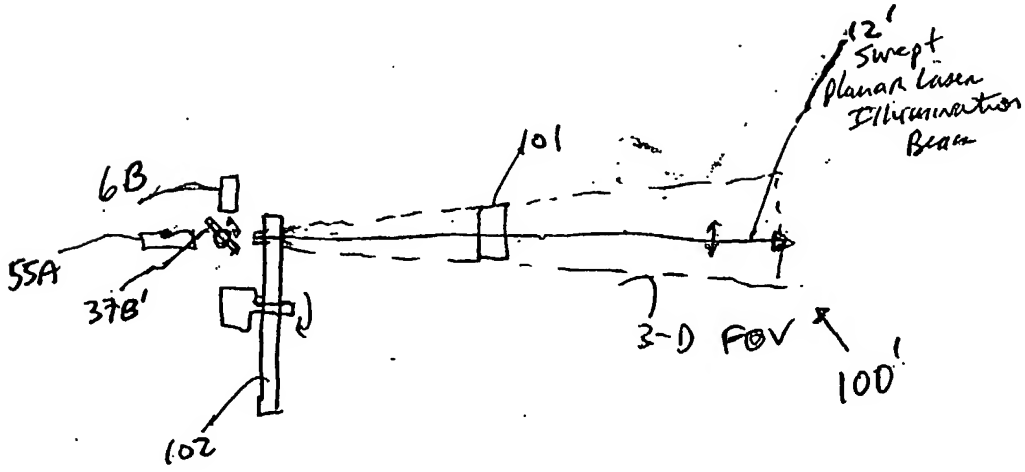

FIG. 8B

1-D CCD SCANNER EMBODIMENT

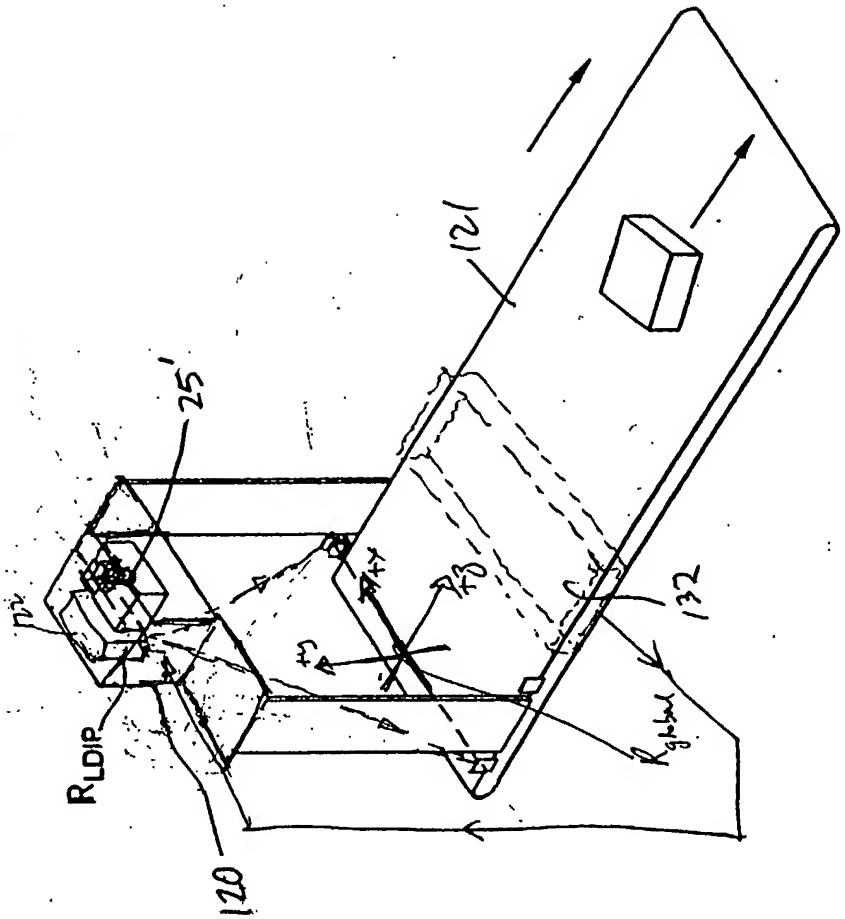

FIG. 9

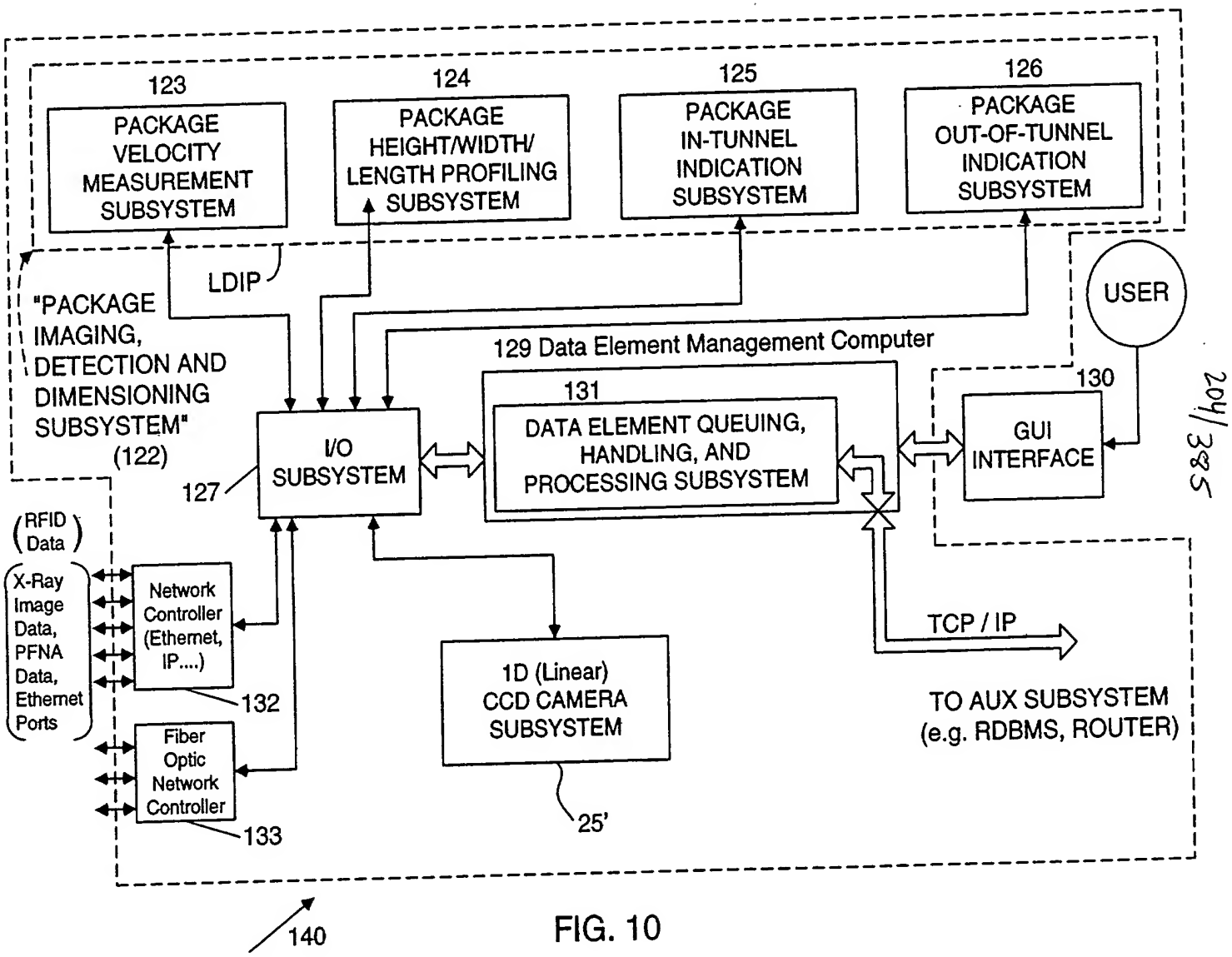
123
PACKAGE VELOCITY MEASUREMENT SUBSYSTEM
124
PACKAGE HEIGHT/WIDTH/ LENGTH PROFILING SUBSYSTEM
125
PACKAGE IN-TUNNEL INDICATION SUBSYSTEM
126
PACKAGE OUT-OF-TUNNEL INDICATION SUBSYSTEM
LDIP
"PACKAGE IMAGING, DETECTION AND DIMENSIONING SUBSYSTEM" (122)
USER
129 Data Element Management Computer
131
DATA ELEMENT QUEUING, HANDLING, AND PROCESSING SUBSYSTEM
130
GUI INTERFACE
I/O SUBSYSTEM
127
(RFID Data)
X-Ray Image Data, PFNA Data, Ethernet Ports
Network Controller (Ethernet, IP....)
132
Fiber Optic Network Controller
133
1D (Linear) CCD CAMERA SUBSYSTEM
25'
TCP / IP
TO AUX SUBSYSTEM (e.g. RDBMS, ROUTER)
140

FIG. 10

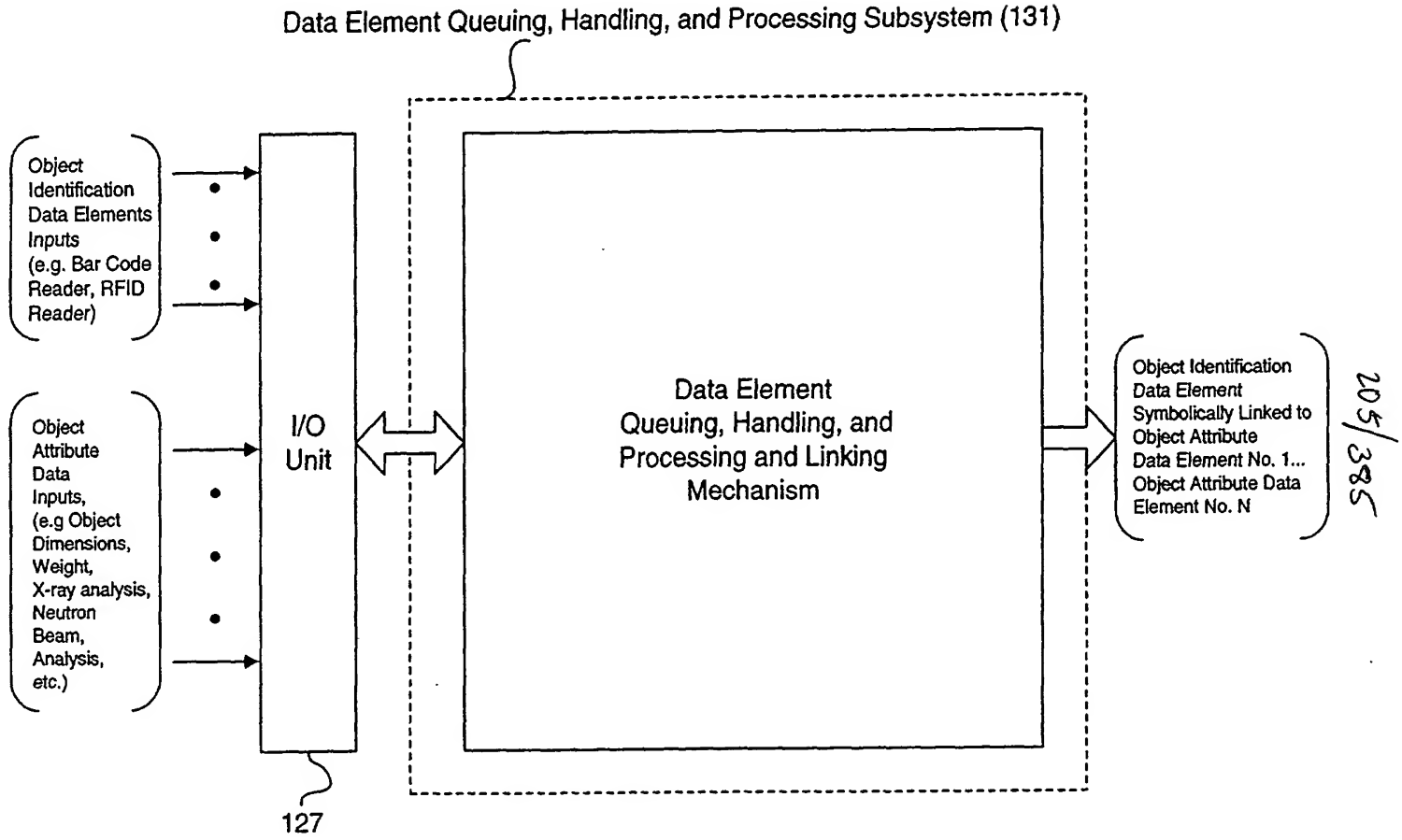
Data Element Queuing, Handling, and Processing Subsystem (131)
Object Identification Data Elements Inputs (e.g. Bar Code Reader, RFID Reader)
Object Attribute Data Inputs, (e.g Object Dimensions, Weight, X-ray analysis, Neutron Beam, Analysis, etc.)
I/O Unit
Data Element Queuing, Handling, and Processing and Linking Mechanism
Object Identification Data Element Symbolically Linked to Object Attribute Data Element No. 1... Object Attribute Data Element No. N
205/385
127

FIG. 10A

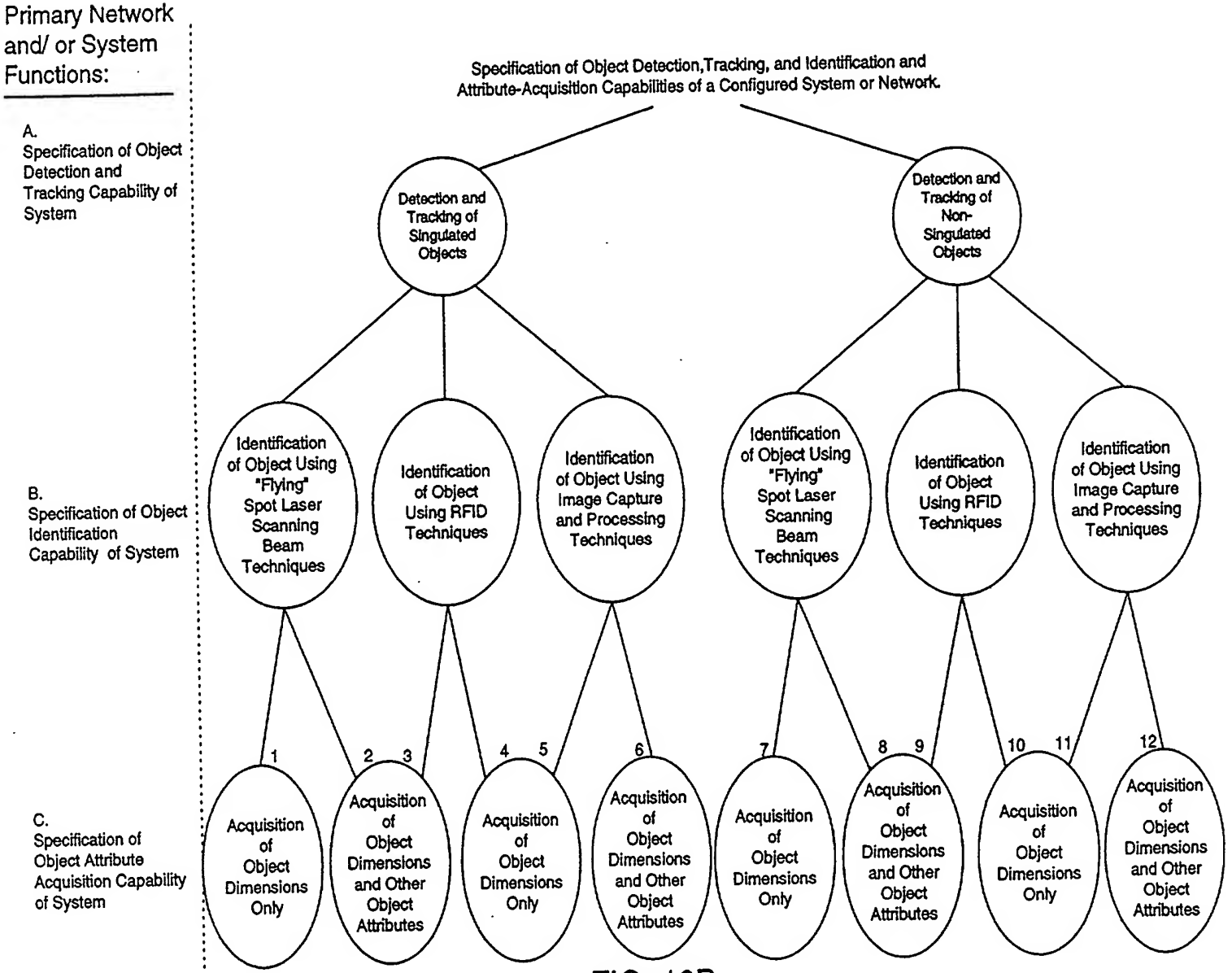

FIG. 10B

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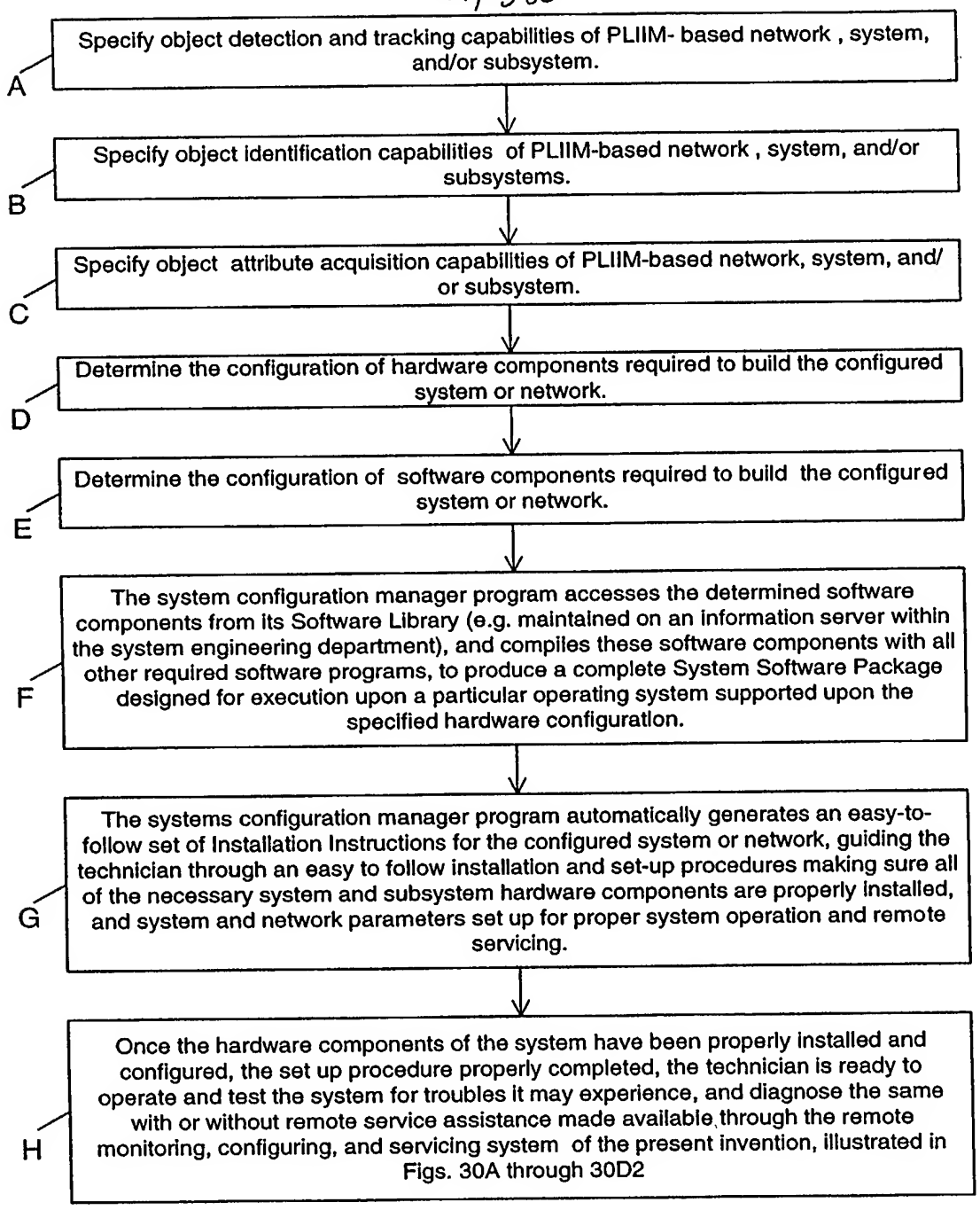

A
Specify object detection and tracking capabilities of PLIIM- based network , system, and/or subsystem.
B
Specify object identification capabilities of PLIIM-based network , system, and/or subsystems.
C
Specify object attribute acquisition capabilities of PLIIM-based network, system, and/or subsystem.
D
Determine the configuration of hardware components required to build the configured system or network.
E
Determine the configuration of software components required to build the configured system or network.
F
The system configuration manager program accesses the determined software components from its Software Library (e.g. maintained on an information server within the system engineering department), and compiles these software components with all other required software programs, to produce a complete System Software Package designed for execution upon a particular operating system supported upon the specified hardware configuration.
G
The systems configuration manager program automatically generates an easy-to-follow set of Installation Instructions for the configured system or network, guiding the technician through an easy to follow installation and set-up procedures making sure all of the necessary system and subsystem hardware components are properly installed, and system and network parameters set up for proper system operation and remote servicing.
H
Once the hardware components of the system have been properly installed and configured, the set up procedure properly completed, the technician is ready to operate and test the system for troubles it may experience, and diagnose the same with or without remote service assistance made available through the remote monitoring, configuring, and servicing system of the present invention, illustrated in Figs. 30A through 30D2

FIG. 10C

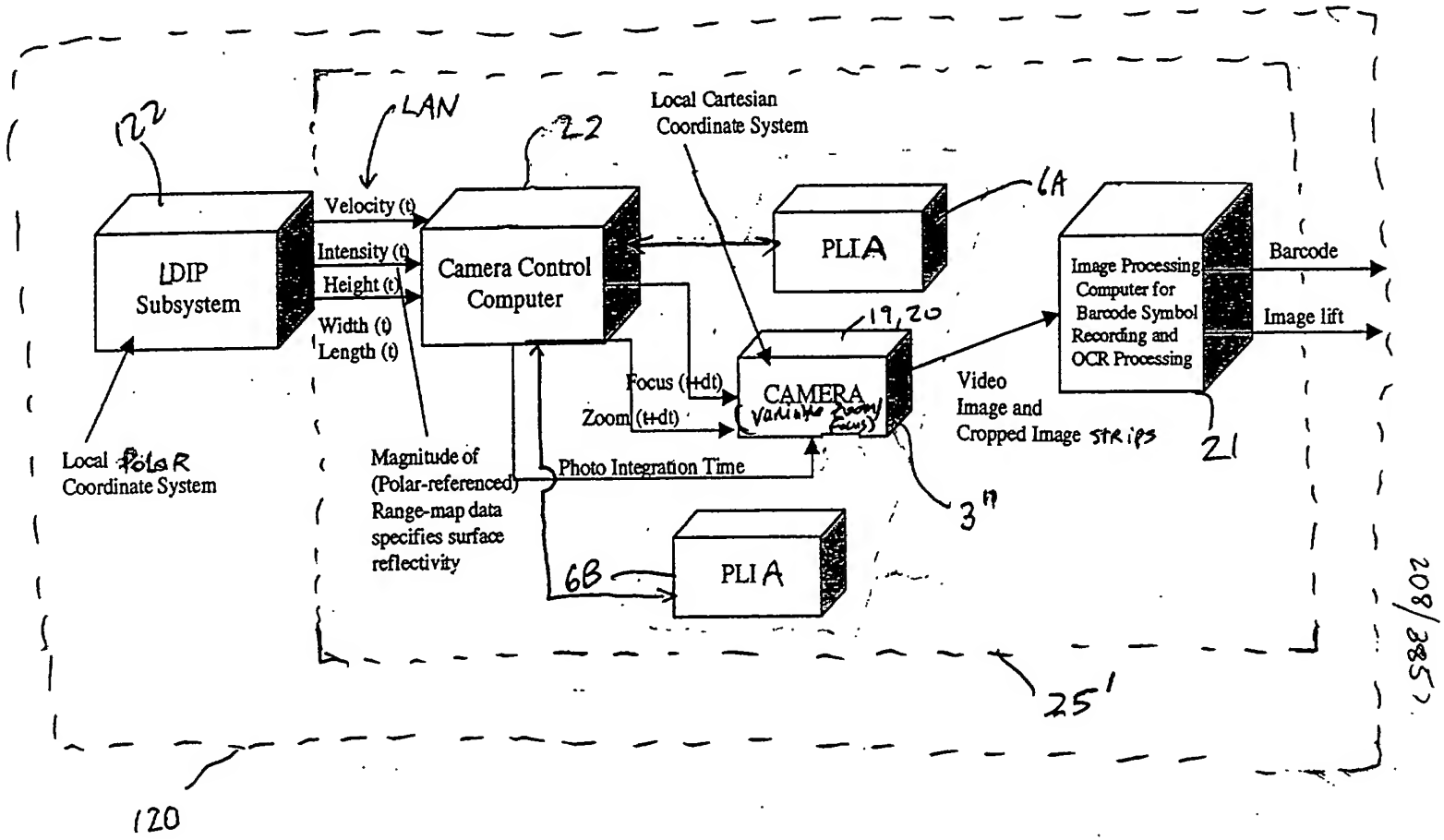

122
LAN
22
Local Cartesian
Coordinate System
LDIP
Subsystem
Velocity (t)
Intensity (t)
Height (t)
Width (t)
Length (t)
Camera Control
Computer
PLIA
1A
19,20
CAMERA
Variable Zoom Lens
Image Processing
Computer for
Barcode Symbol
Recording and
OCR Processing
Barcode
Image lift
Focus (t+dt)
Zoom (t+dt)
Photo Integration Time
Video
Image and
Cropped Image Strips
21
3"
Local Polar
Coordinate System
Magnitude of
(Polar-referenced)
Range-map data
specifies surface
reflectivity
6B
PLIA
25'
120
588/802

FIG. 11

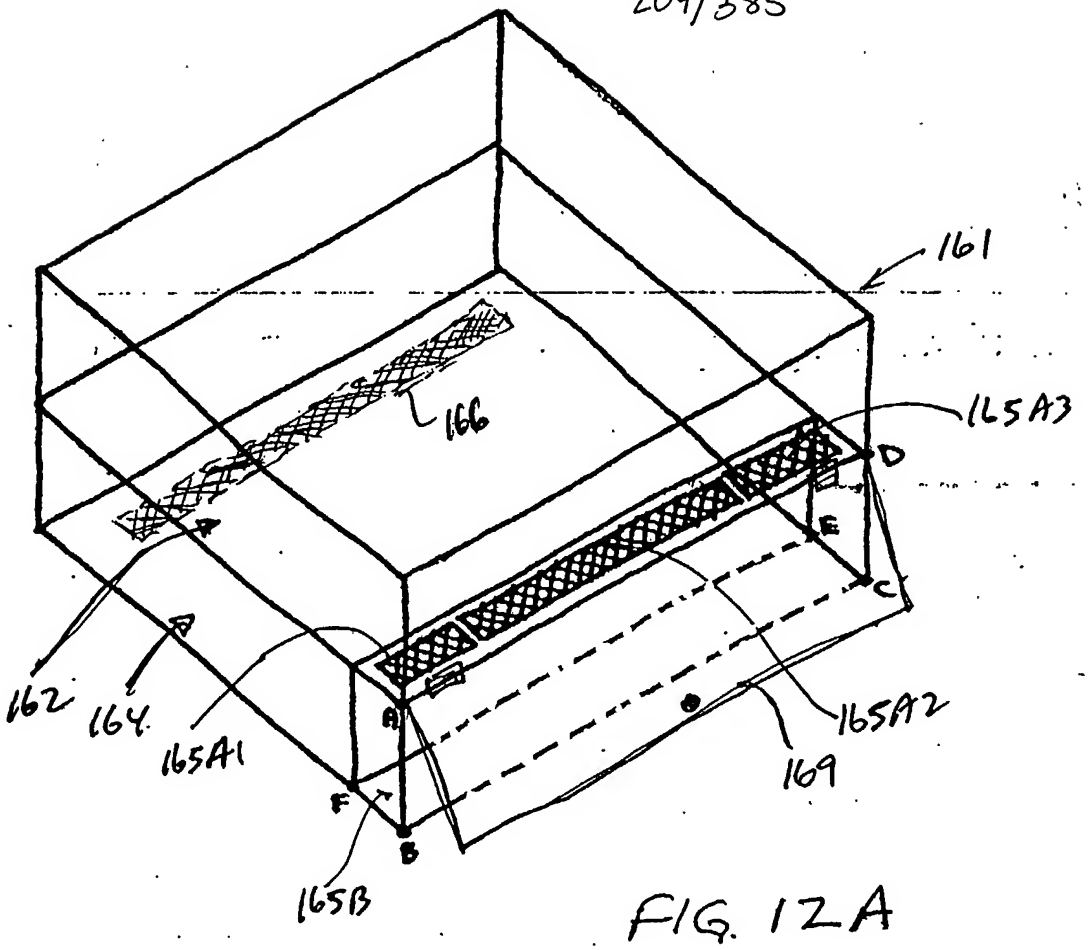


FIG. 12A

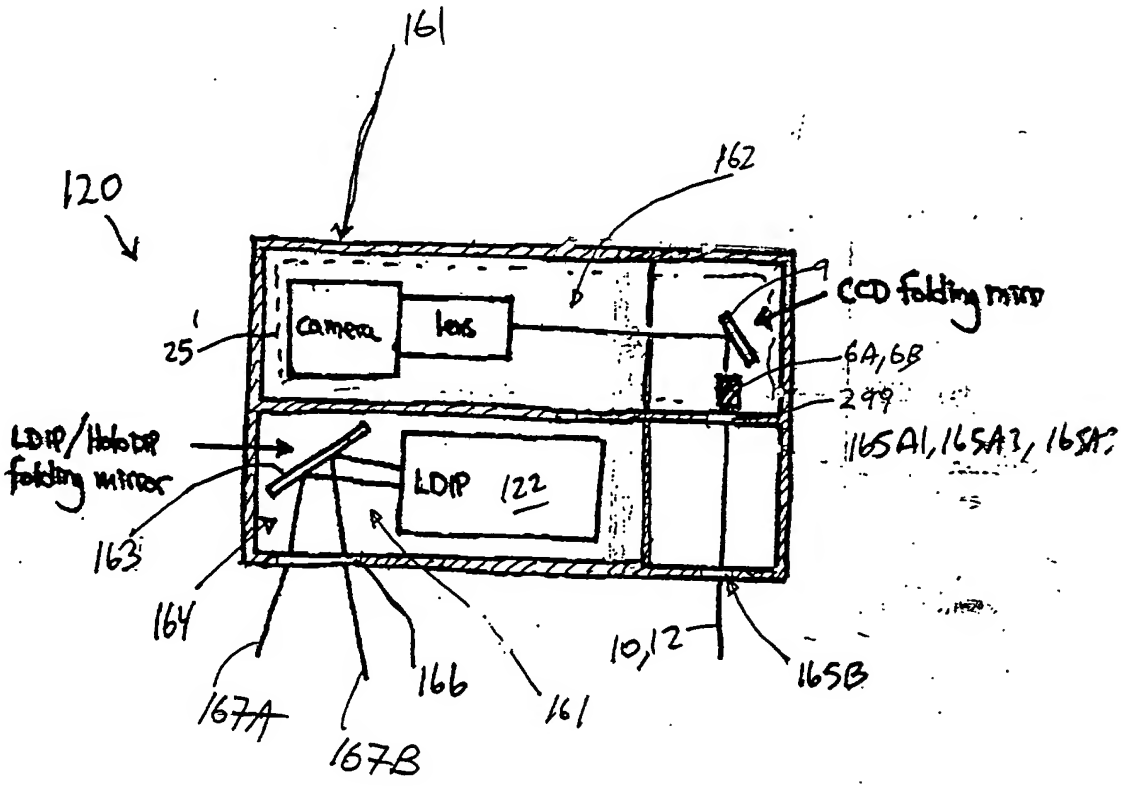


FIG. 12B

EP 2 220 517 B1

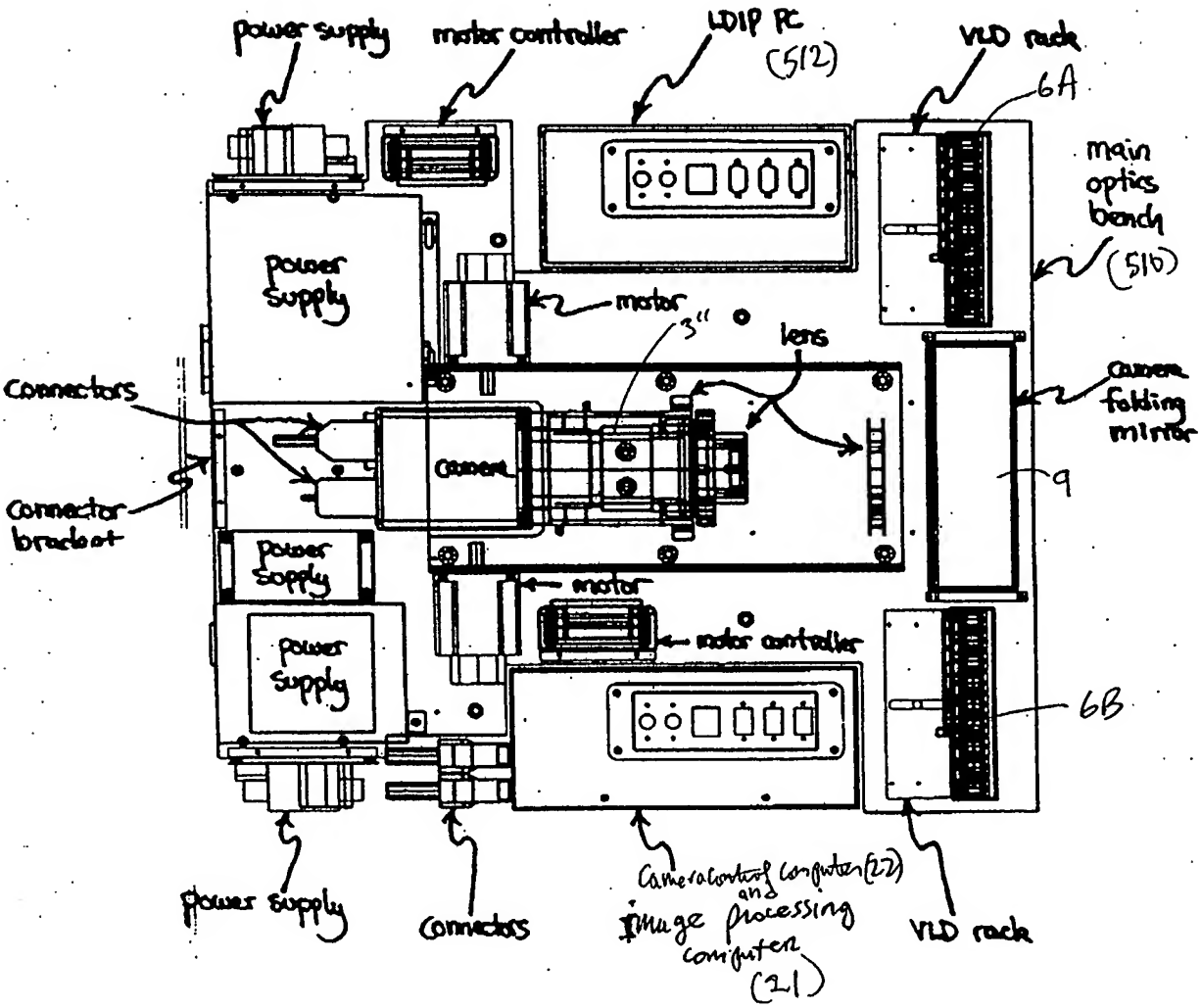

power supply
motor controller
LDIP PC (512)
VLD rack
6A
main optics bench (510)
power supply
motor
3"
lens
Connectors
camera
camera folding mirror
9
Connector bracket
power supply
motor
power supply
motor controller
6B
power supply
Connectors
Camera control computer (22) and Image processing computer (21)
VLD rack

FIG. 12C

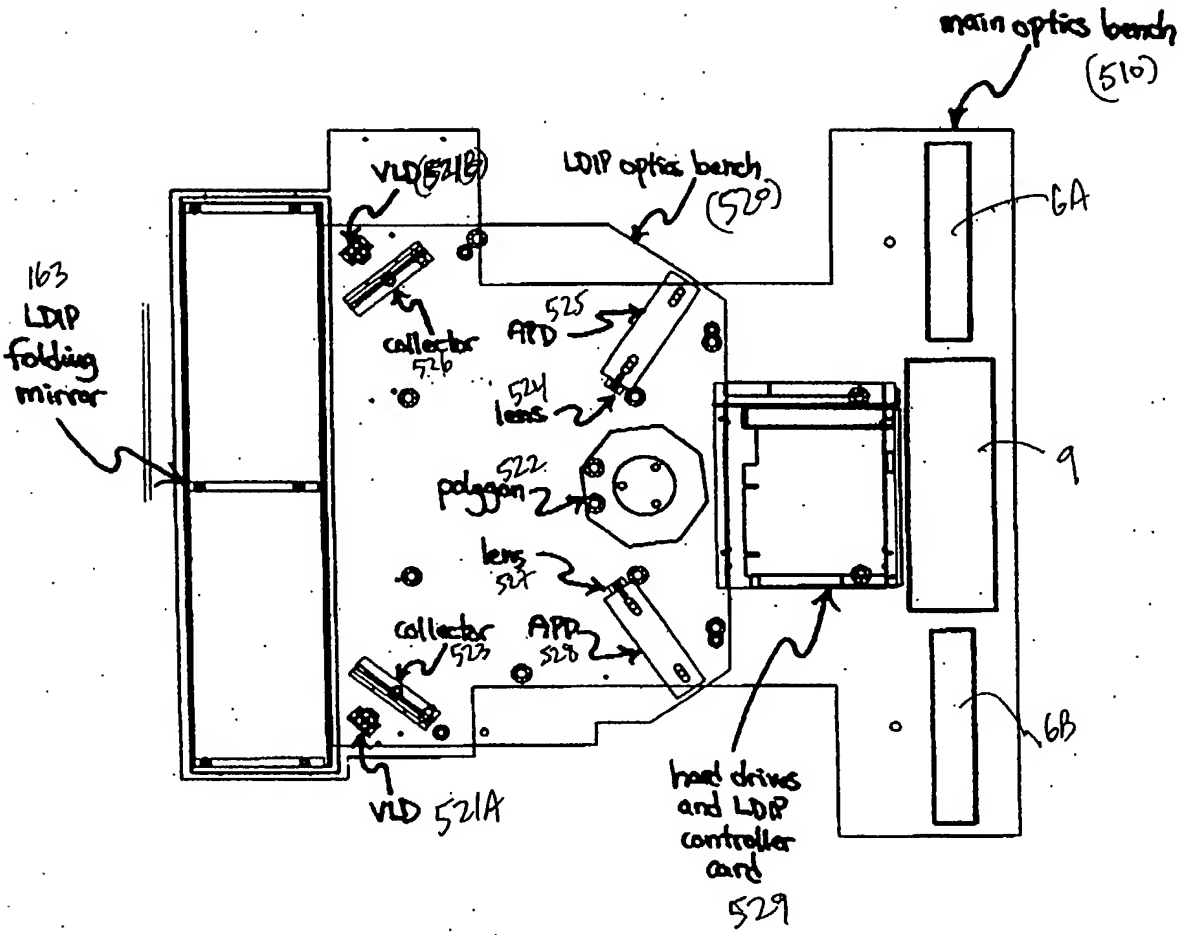
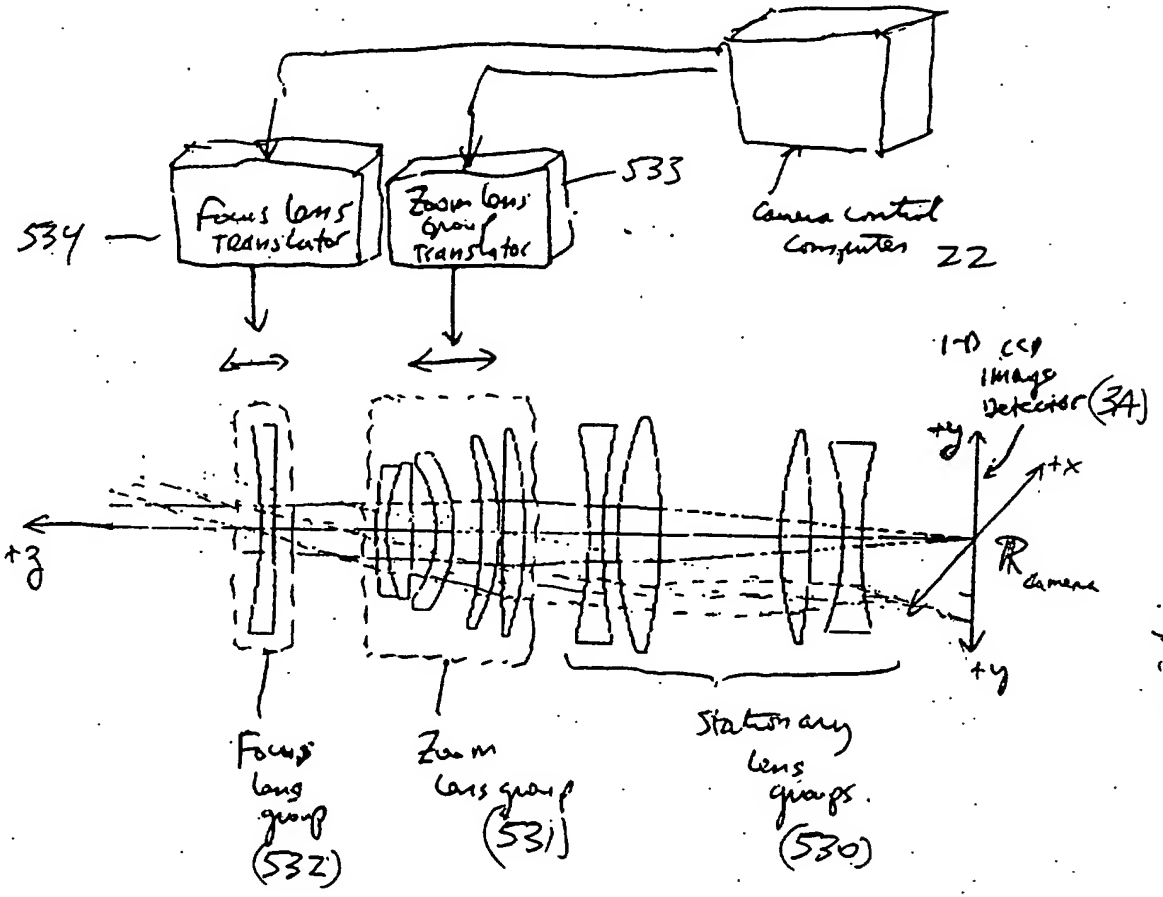

main optics bench
(510)
VLD(521B)
LDIP optics bench
(529)
6A
163
LDIP
folding
mirror
collector
526
APD
525
524
lens
polygon
522
9
lens
527
collector
523
APD
528
6B
VLD 521A
host drive
and LDIP
controller
card
529

FIG. 12D



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(main optics)
(Lens groups)

FIG. 12E

EL908492702US

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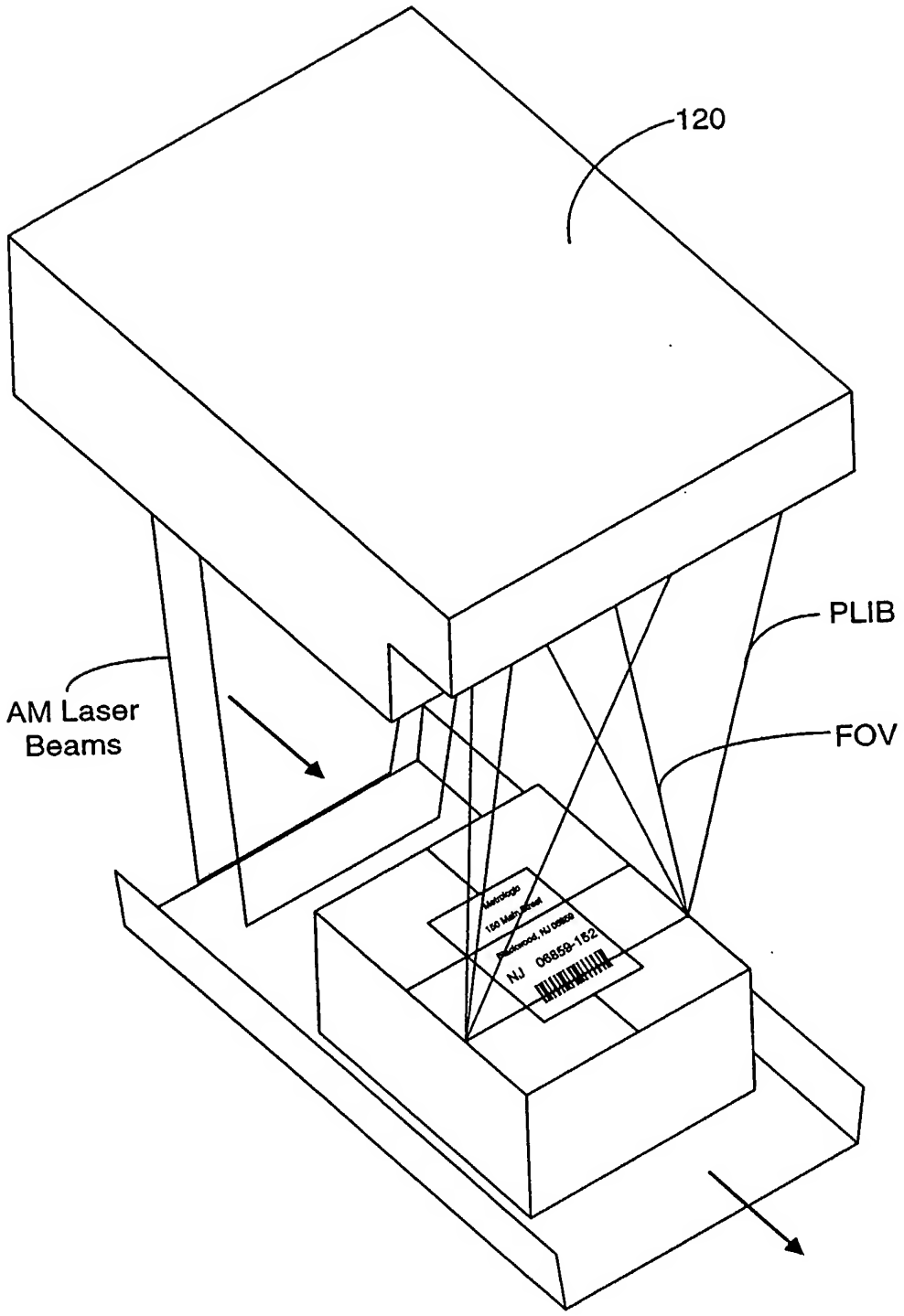

FIG. 13A

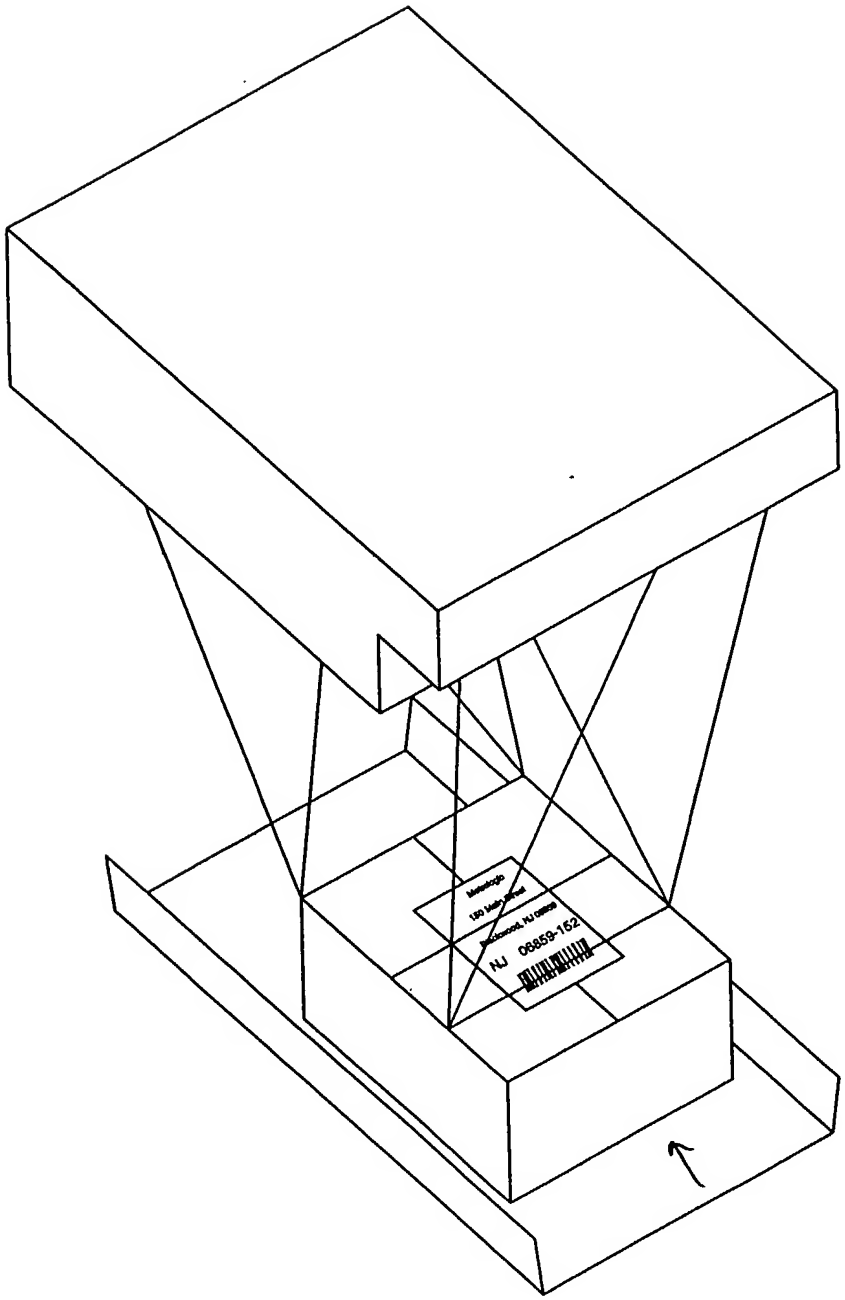

FIG. 13A

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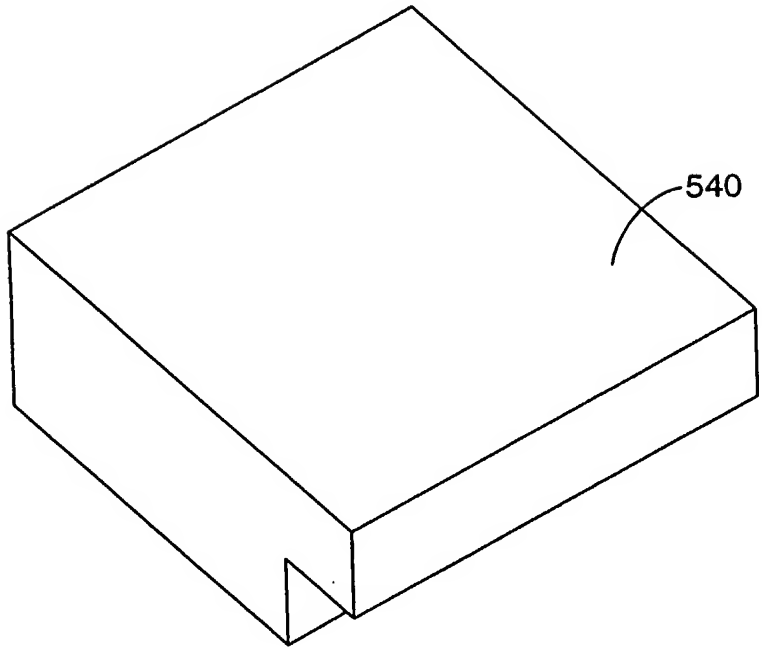

FIG. 13B

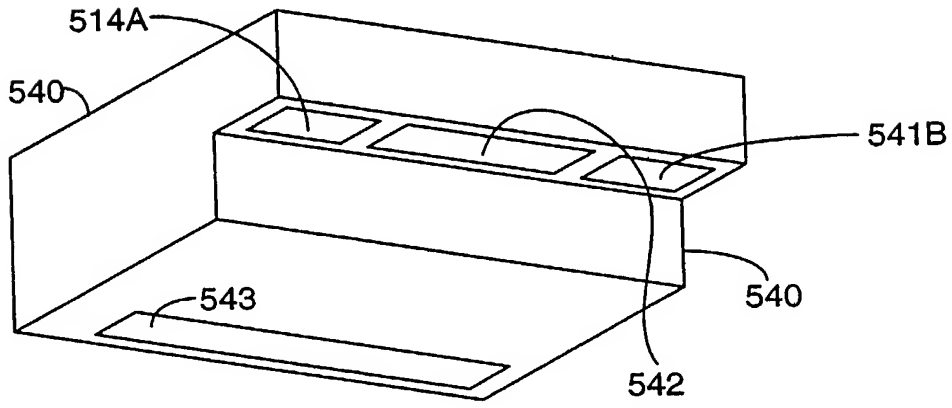

FIG. 13C

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PLLIM-BASED PACKAGE IDENTIFICATION AND DIMENSIONING (PID) SYSTEM

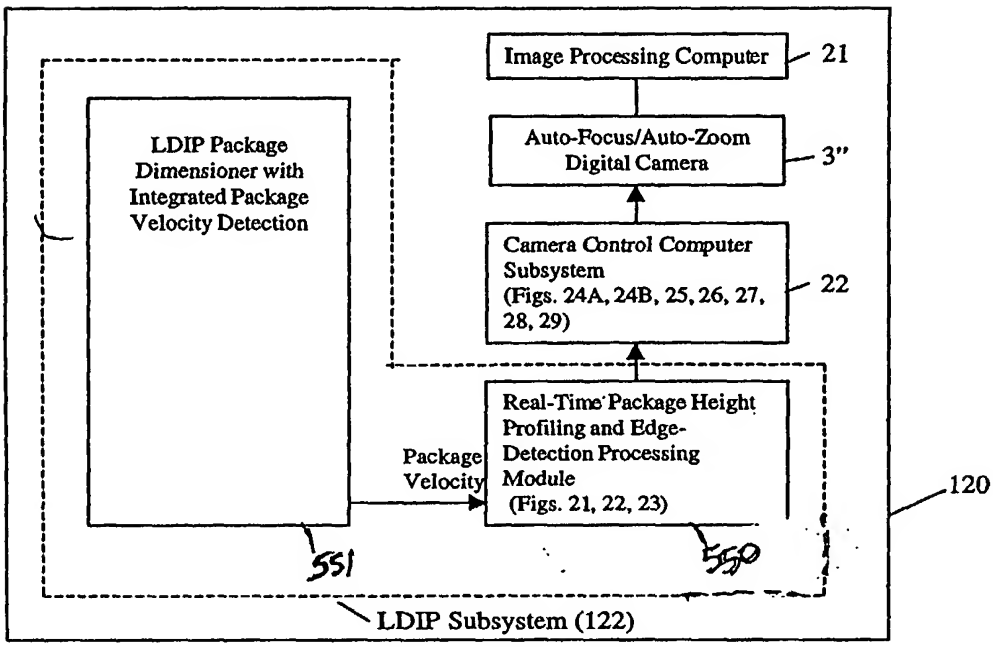

FIG. 14

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LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

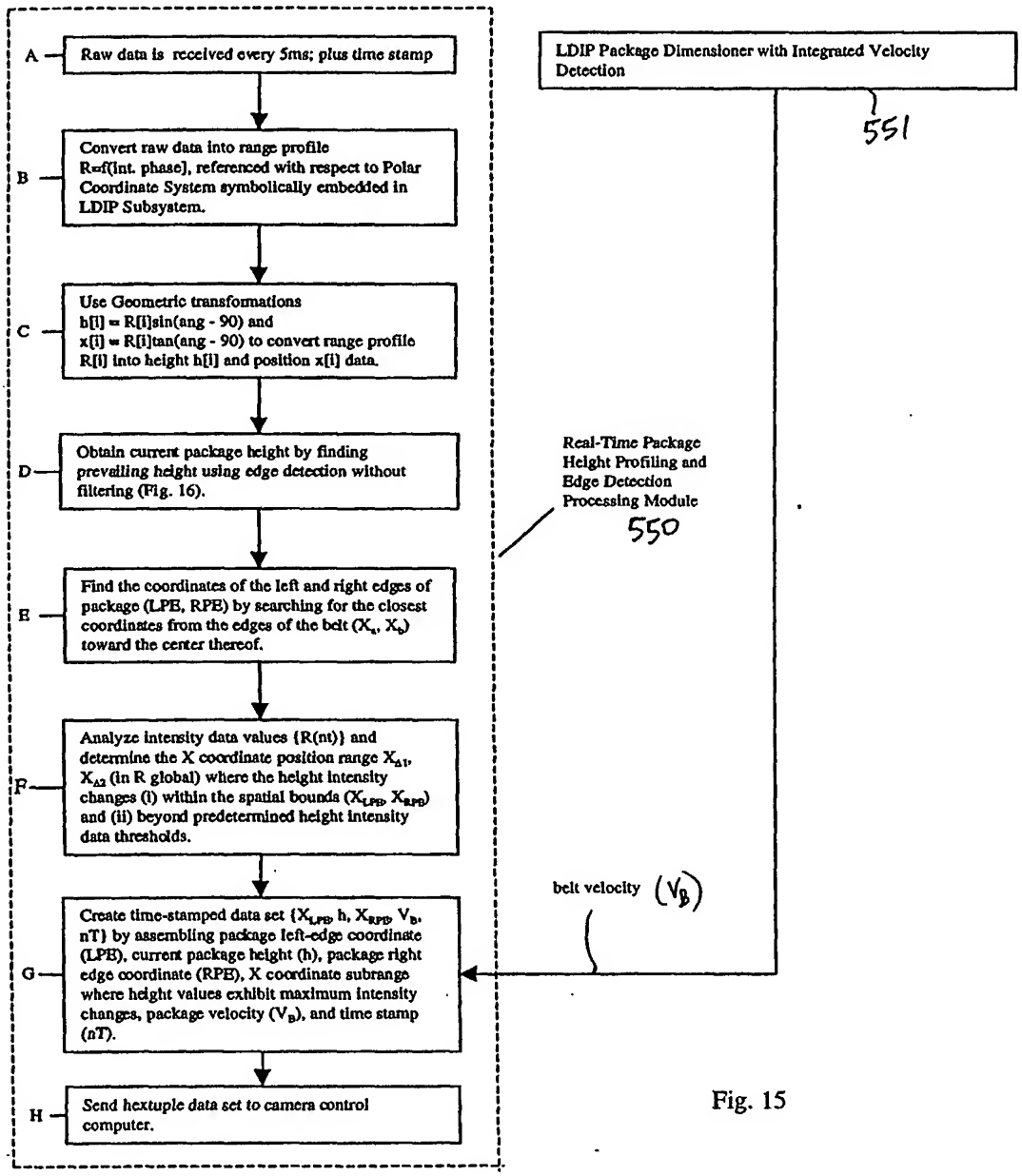

Fig. 15

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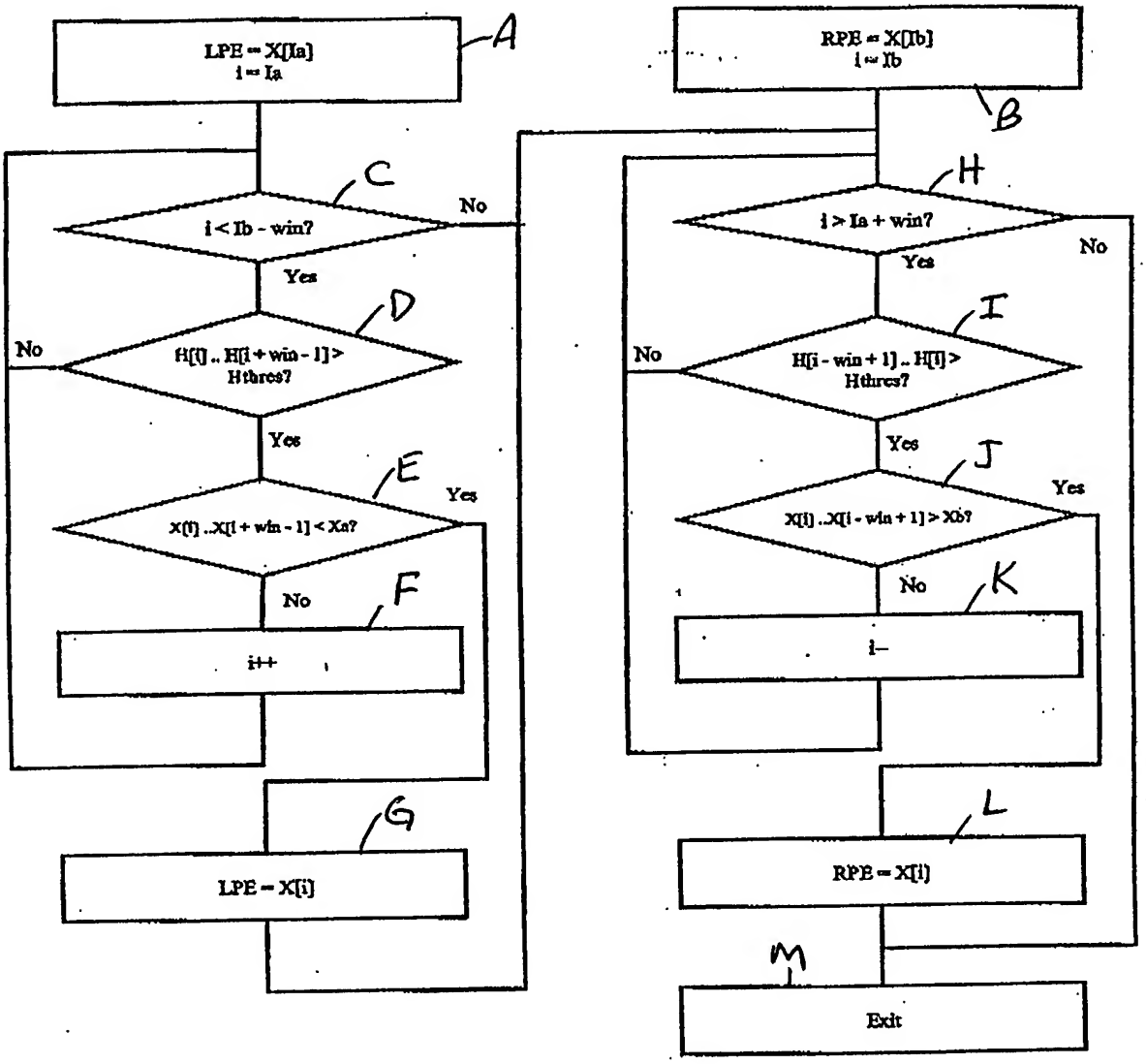
LDIP Real Time Package Edge Detection



Xa = location of belt left edge; Xb = location of belt right edge
Ia = belt edge edge pixel; Ib = belt right edge pixel
LPE = Left package edge; RPE = Right package edge
H[] = Pixel height array; X[] = Pixel location array
win = package detection window

FIG. 16

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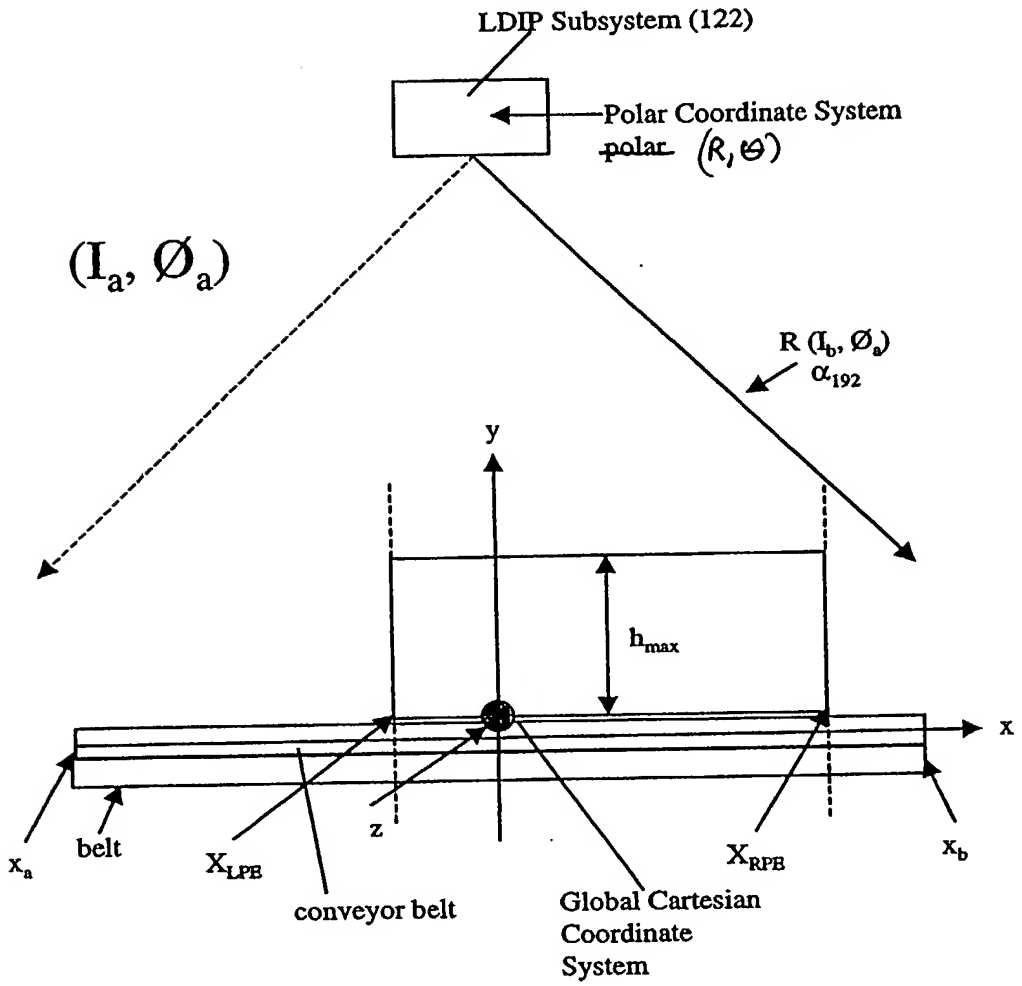

Fig. 17

INFORMATION MEASURED AT SCAN ANGLES BEFORE COORDINATE TRANSFORMS

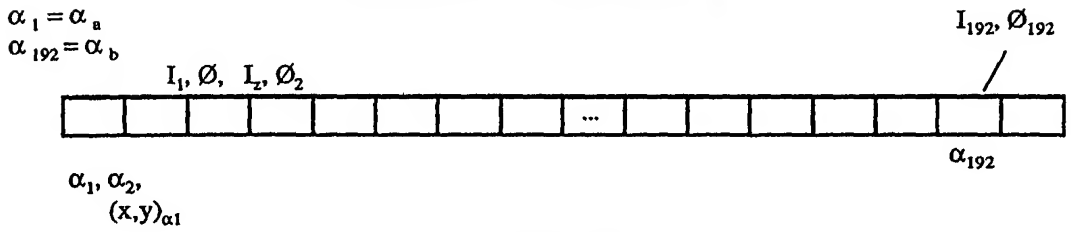

Fig. 17A

RANGE AND POLAR ANGLE MEASURES TAKEN AT SCAN ANGLE α BEFORE COORDINATE TRANSFORMS

Fig. 17B

MEASURED PACKAGE HEIGHT AND POSITION VALUES AFTER COORDINATE TRANSFORMS

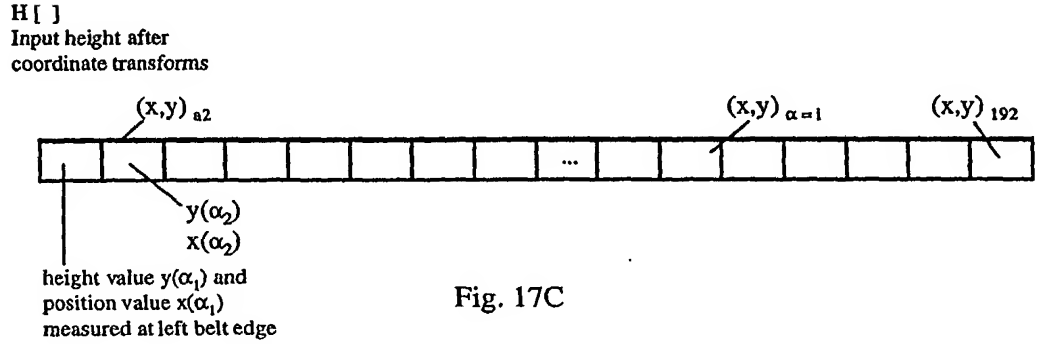

Fig. 17C

CAMERA CONTROL PROCESS CARRIED OUT WITHIN THE CAMERA CONTROL SUBSYSTEM OF EACH OBJECT IDENTIFICATION AND ATTRIBUTE ACQUISITION SYSTEM OF PRESENT INVENTION

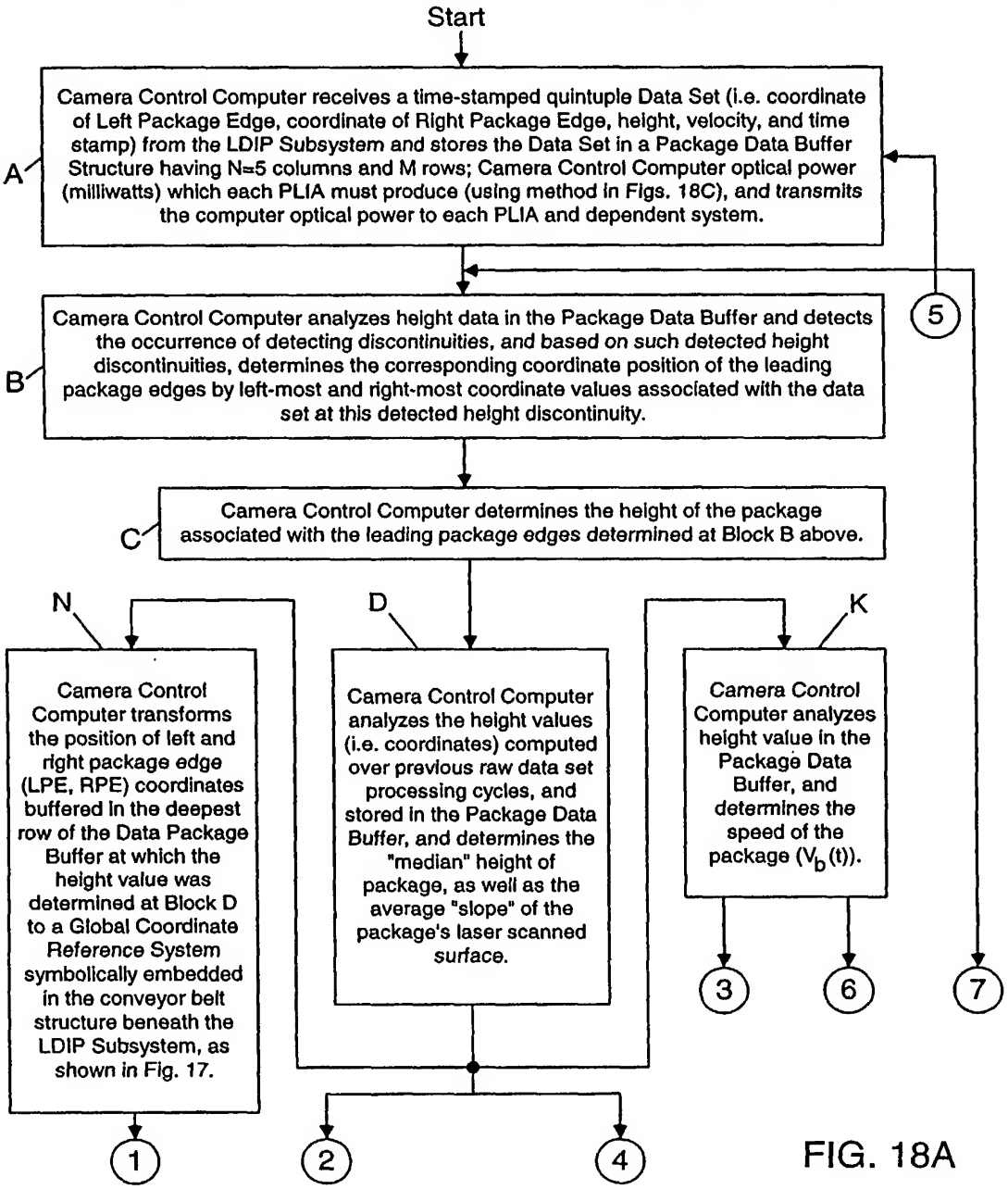

FIG. 18A

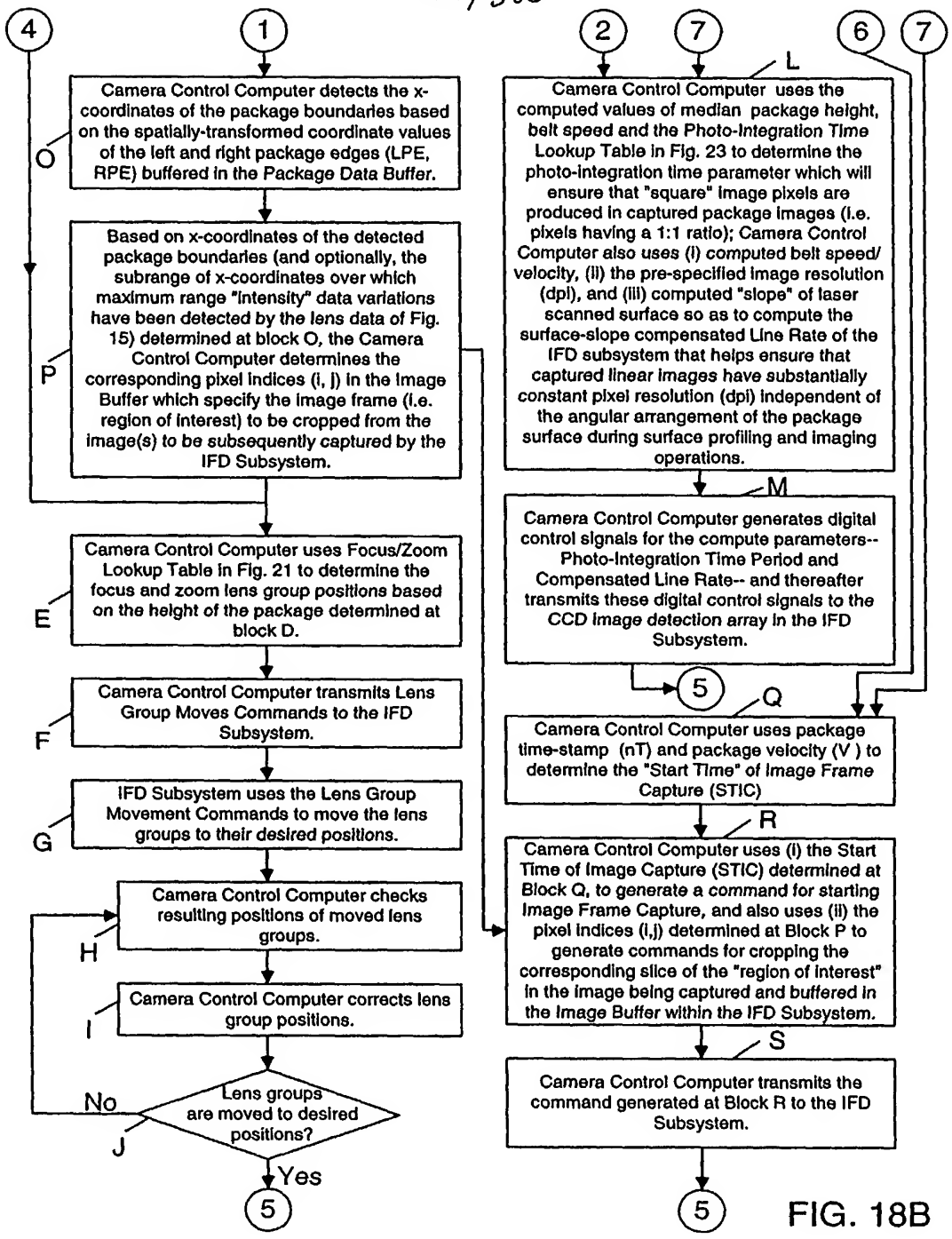
4
1
2
7
6
7
O
Camera Control Computer detects the x-coordinates of the package boundaries based on the spatially-transformed coordinate values of the left and right package edges (LPE, RPE) buffered in the Package Data Buffer.
P
Based on x-coordinates of the detected package boundaries (and optionally, the subrange of x-coordinates over which maximum range "intensity" data variations have been detected by the lens data of Fig. 15) determined at block O, the Camera Control Computer determines the corresponding pixel indices (i, j) in the Image Buffer which specify the image frame (i.e. region of interest) to be cropped from the image(s) to be subsequently captured by the IFD Subsystem.
E
Camera Control Computer uses Focus/Zoom Lookup Table in Fig. 21 to determine the focus and zoom lens group positions based on the height of the package determined at block D.
F
Camera Control Computer transmits Lens Group Moves Commands to the IFD Subsystem.
G
IFD Subsystem uses the Lens Group Movement Commands to move the lens groups to their desired positions.
H
Camera Control Computer checks resulting positions of moved lens groups.
I
Camera Control Computer corrects lens group positions.
J
Lens groups are moved to desired positions?
No
Yes
5
L
Camera Control Computer uses the computed values of median package height, belt speed and the Photo-Integration Time Lookup Table in Fig. 23 to determine the photo-integration time parameter which will ensure that "square" image pixels are produced in captured package images (i.e. pixels having a 1:1 ratio); Camera Control Computer also uses (i) computed belt speed/velocity, (ii) the pre-specified image resolution (dpi), and (iii) computed "slope" of laser scanned surface so as to compute the surface-slope compensated Line Rate of the IFD subsystem that helps ensure that captured linear images have substantially constant pixel resolution (dpi) independent of the angular arrangement of the package surface during surface profiling and imaging operations.
M
Camera Control Computer generates digital control signals for the compute parameters-- Photo-Integration Time Period and Compensated Line Rate-- and thereafter transmits these digital control signals to the CCD image detection array in the IFD Subsystem.
5
Q
Camera Control Computer uses package time-stamp (nT) and package velocity (V) to determine the "Start Time" of Image Frame Capture (STIC)
R
Camera Control Computer uses (i) the Start Time of Image Capture (STIC) determined at Block Q, to generate a command for starting Image Frame Capture, and also uses (ii) the pixel indices (i,j) determined at Block P to generate commands for cropping the corresponding slice of the "region of interest" in the image being captured and buffered in the Image Buffer within the IFD Subsystem.
S
Camera Control Computer transmits the command generated at Block R to the IFD Subsystem.
5

FIG. 18B

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METHOD OF COMPUTING OPTICAL OUTPUT POWER FROM CASE DIODES IN PLANAR LASER ILUMINATION ARRAY (PLIA) FOR CONTROLLING CONSTANT WHITE LEVEL IN IMAGE PIXELS CAPTURED BY PLIIM-BASED LINEAR IMAGER

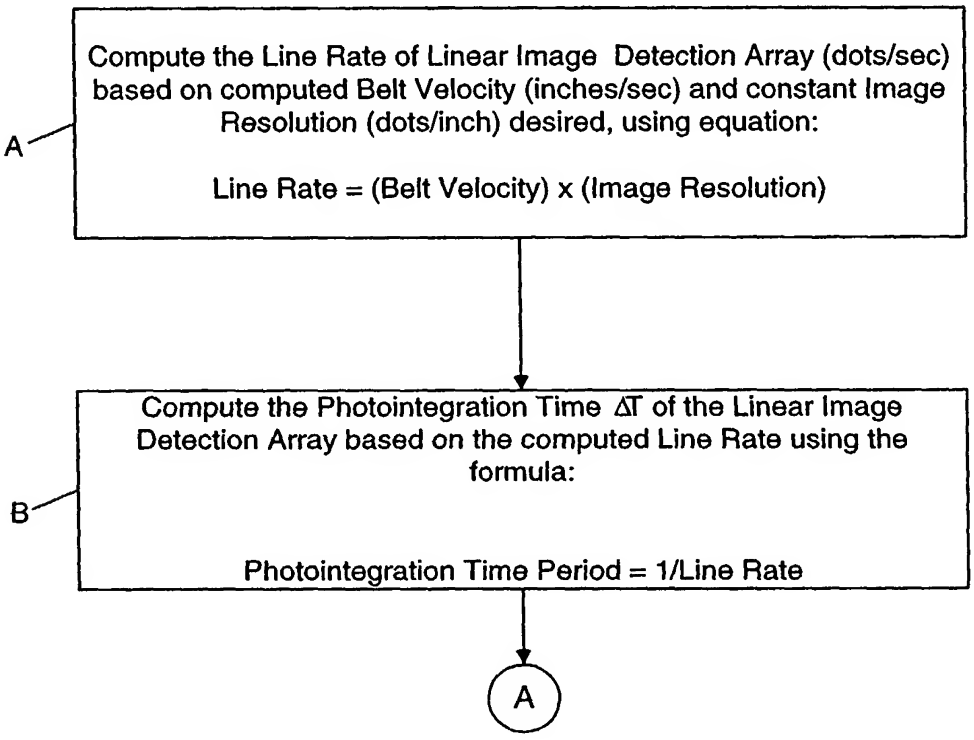

FIG. 18C1

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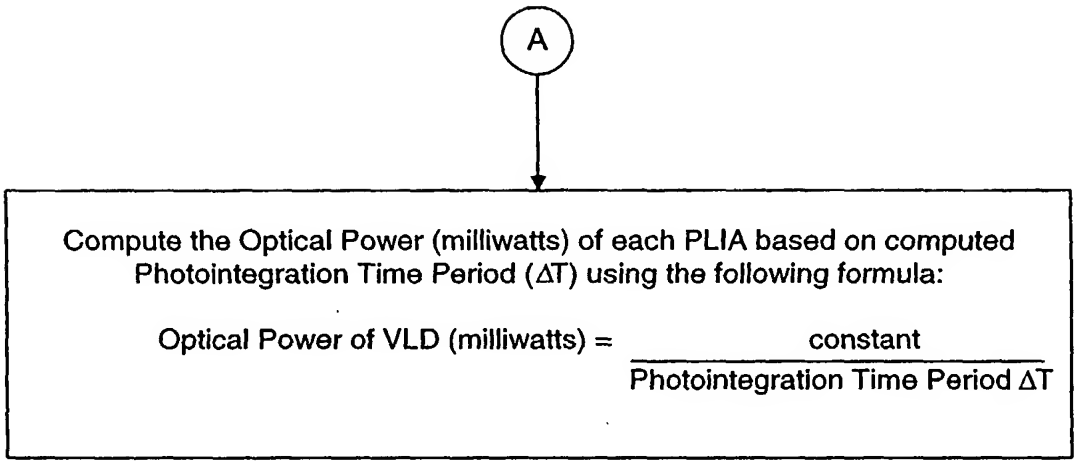

FIG. 18C2

METHOD OF COMPUTING COMPENSATED LINE RATE FOR CORRECTING VIEWING-ANGLE DISTORTION OCCURING IN IMAGES OF OBJECT SURFACES CAPTURED AS OBJECT SURFACES MOVE PAST PLIIM-BASED LINEAR IMAGER AT NON-ZERO SKEWED ANGLE

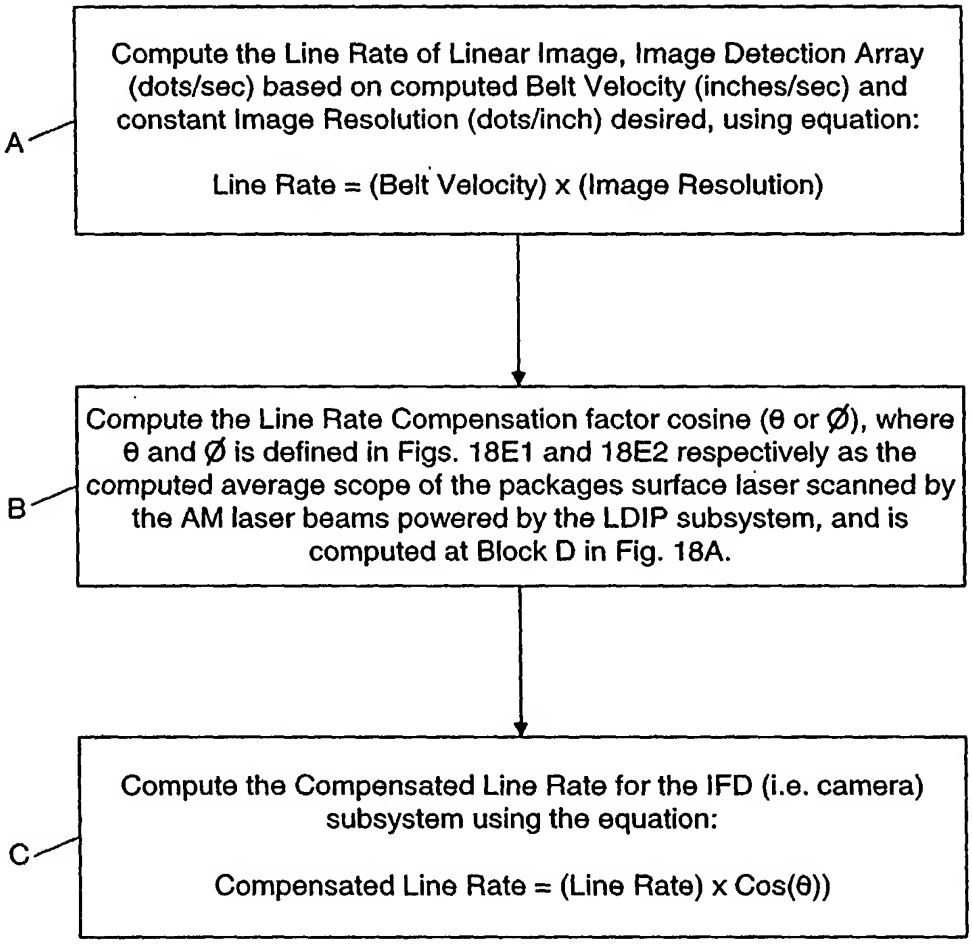

FIG. 18D

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CASE 1:
Top Down Imaging

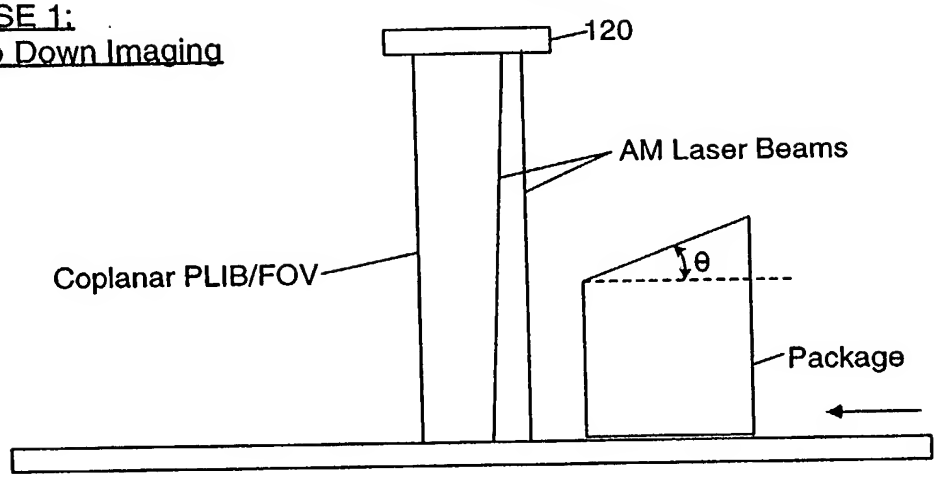


FIG. 18E1

CASE 2:
Side Imaging

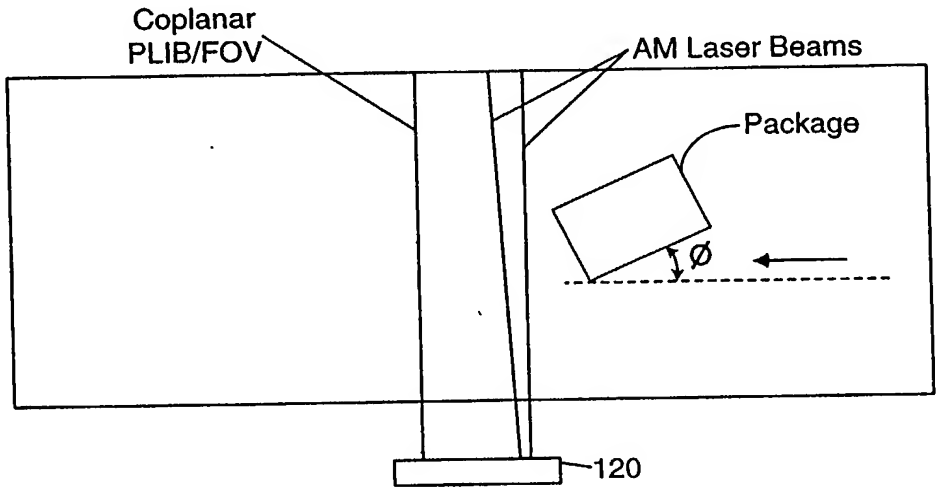


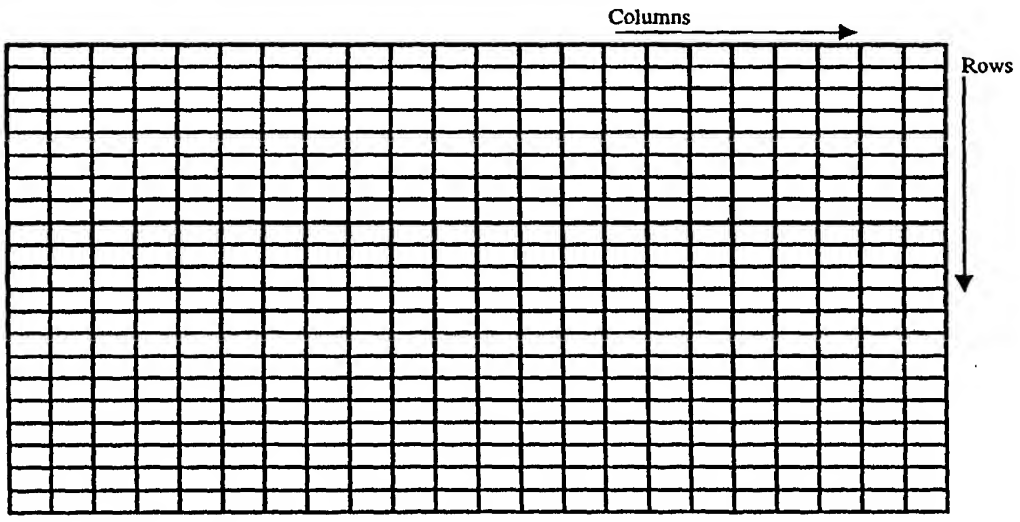
FIG. 18E2

X coordinate subrange where maximum range "intensity" variations have been detected

Left Package Edge (LDE)	Package Height (h)	Right Package Edge (RPE)	Package Velocity	Time-stamp (nT)	
					Row 1
					Row 2
					Row 3
					Row 4
					Row 5
					Row M

Package Data Buffer (FIFO)

Fig. 19



Camera Pixel Data Buffer
pixel indices (i,j)

Fig. 20

Zoom and Focus Lens Group position
Look-up TABLE

Distance from Camera H (mm)	Zoom group distance (mm) Y (Zoom)	Focus group distance (mm) Y (Focus)
1000	21.57489228	2.47E-05
1100	19.38089696	10.99009783
1200	17.10673434	20.65783177
1300	14.77137314	29.10917002
1400	12.39153565	36.47312595
1500	9.979114358	42.87845436
1600	7.540639114	48.44003358
1700	5.078794775	53.25495831
1800	2.595989366	57.40834303
1900	0.099972739	60.98883615

(use interpolation techniques for working distances between listed points in table)

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FIG. 21.

* Note: the focal distance & Zoom (eff. focal length) of camera lens are coupled (via interdependent) in the commercial embodiment.. Camera has a * fixed aperture F56

Focus and Zoom lens movement vs. working distances

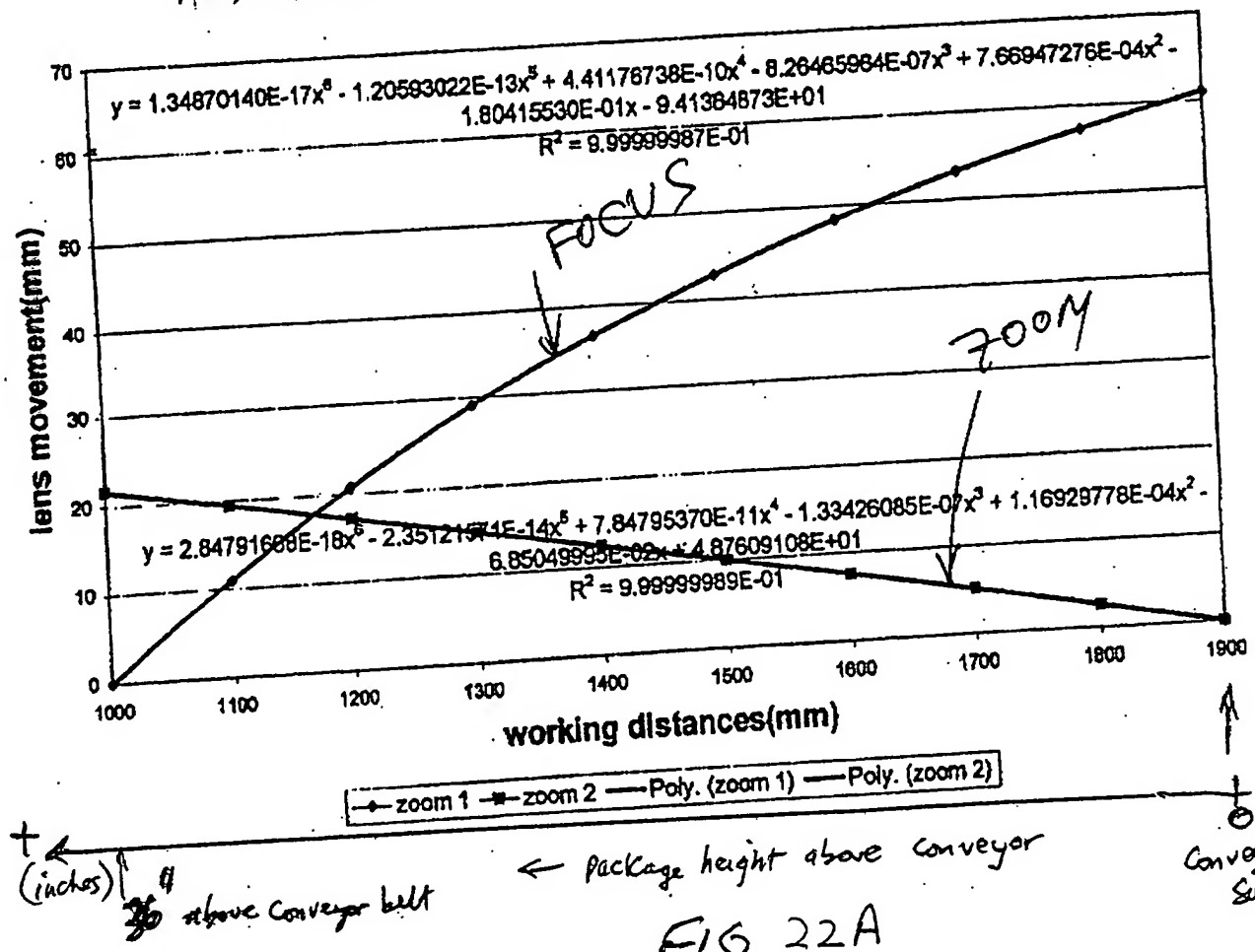

FIG. 22A

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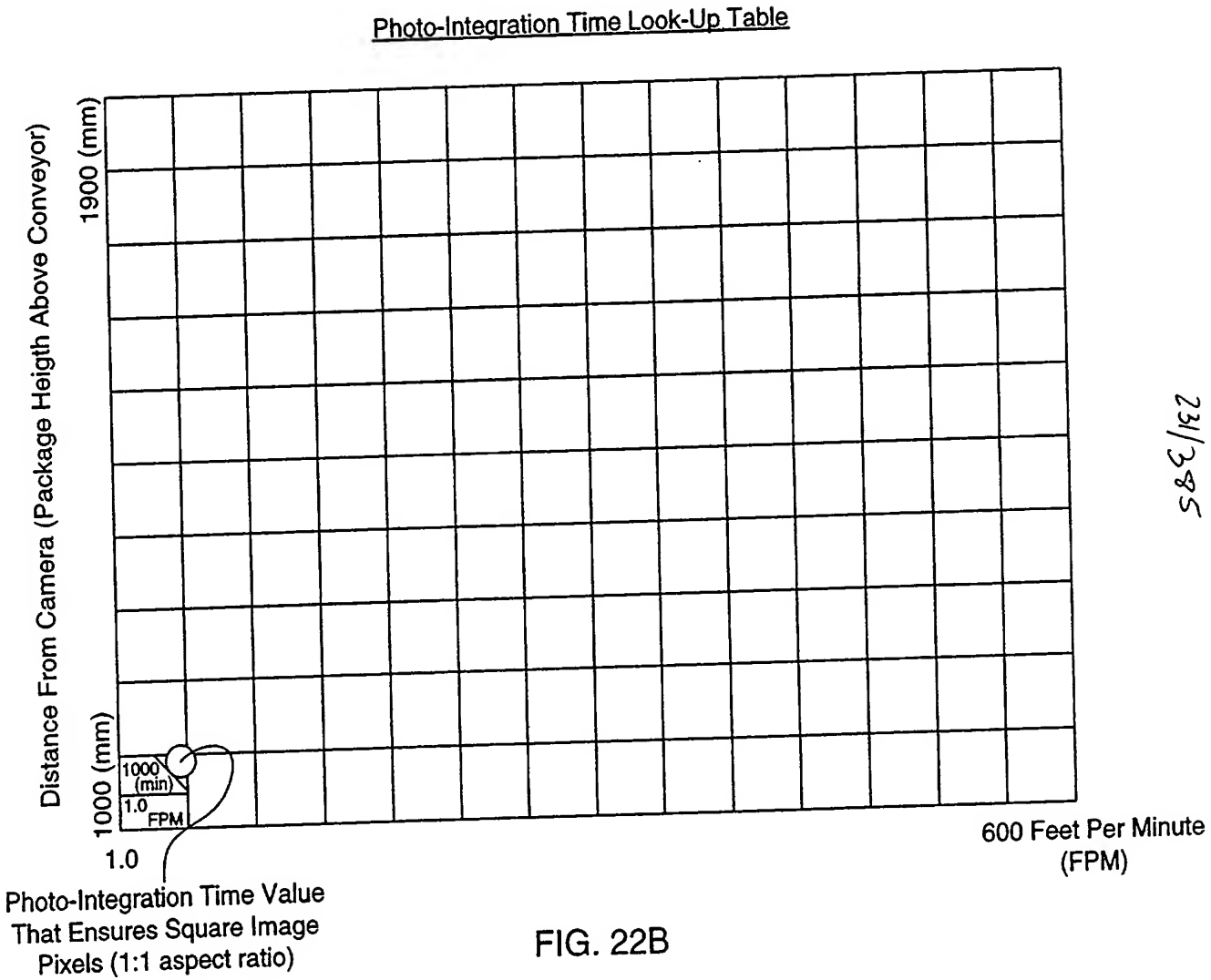

FIG. 22B

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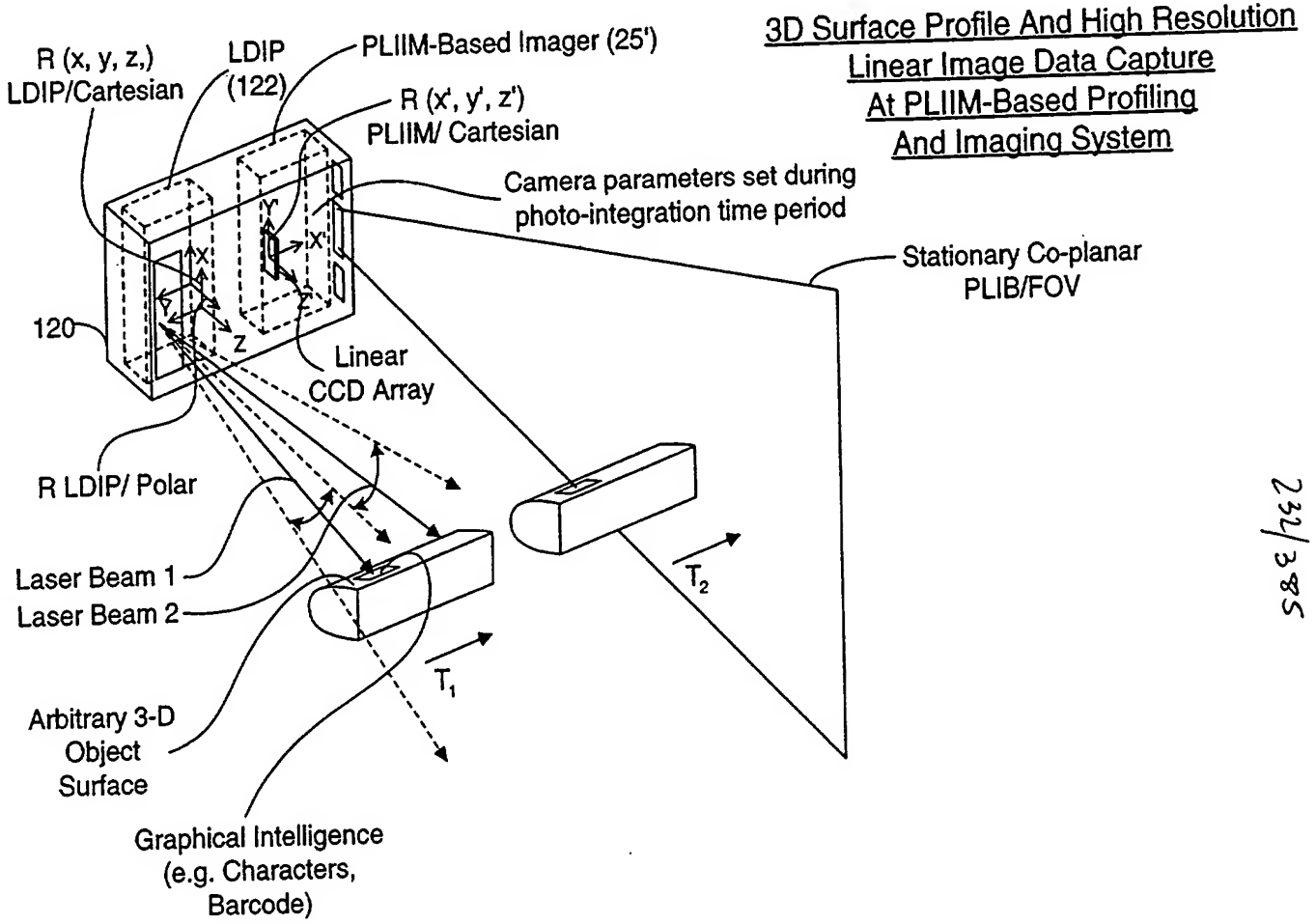
3D Surface Profile And High Resolution
Linear Image Data Capture
At PLIIM-Based Profiling
And Imaging System
R (x, y, z,)
LDIP/Cartesian
LDIP
(122)
PLIIM-Based Imager (25')
R (x', y', z')
PLIIM/ Cartesian
Camera parameters set during
photo-integration time period
Stationary Co-planar
PLIB/FOV
120
Linear
CCD Array
R LDIP/ Polar
Laser Beam 1
Laser Beam 2
Arbitrary 3-D
Object
Surface
Graphical Intelligence
(e.g. Characters,
Barcode)
T1
T2

FIG. 23A

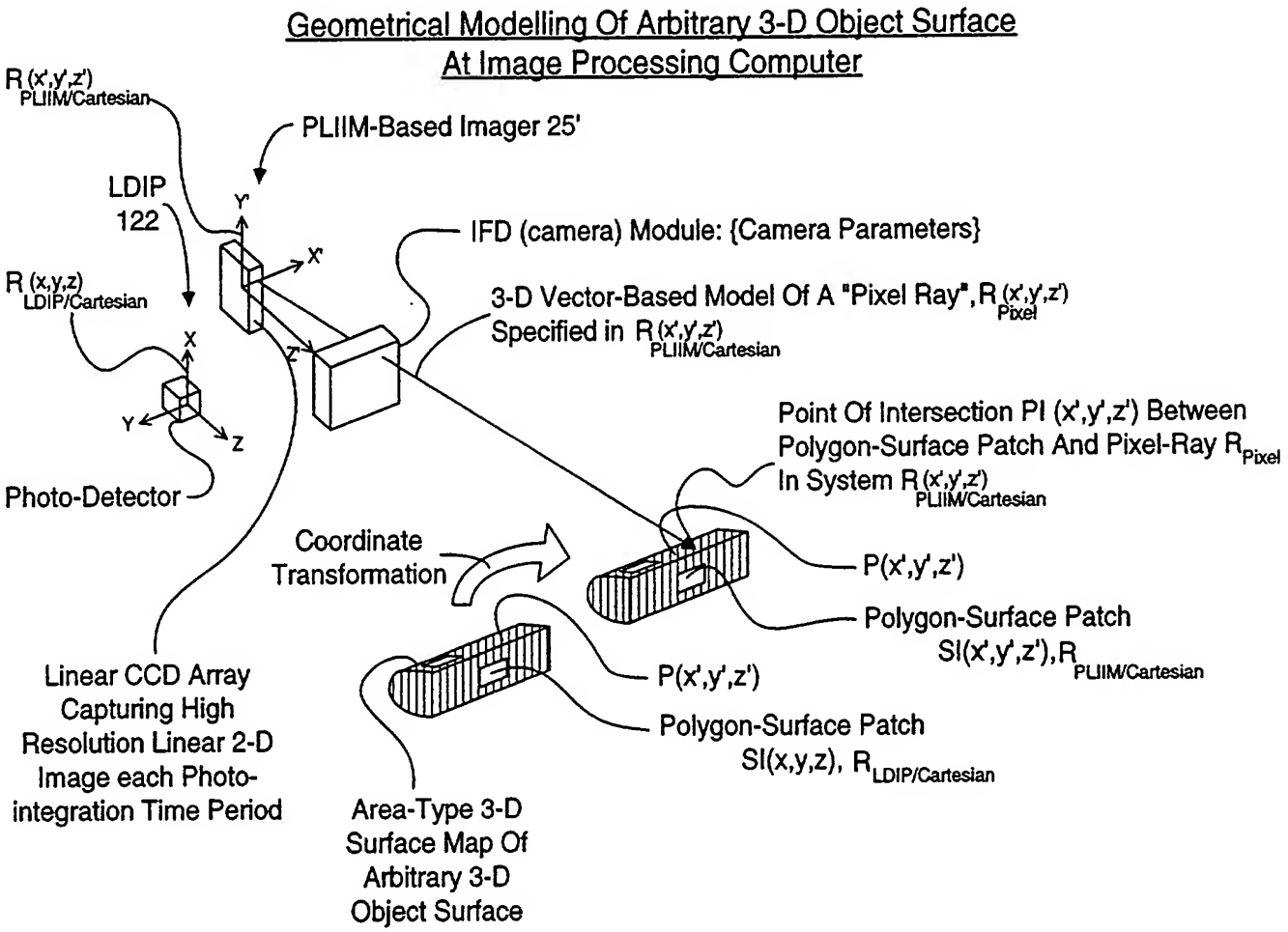
Geometrical Modelling Of Arbitrary 3-D Object Surface
At Image Processing Computer
R (x',y',z') PLIIM/Cartesian
PLIIM-Based Imager 25'
LDIP 122
Y'
X'
Z'
IFD (camera) Module: {Camera Parameters}
R (x,y,z) LDIP/Cartesian
3-D Vector-Based Model Of A "Pixel Ray", R (x',y',z') Pixel
Specified in R (x',y',z') PLIIM/Cartesian
X
Y
Z
Photo-Detector
Point Of Intersection PI (x',y',z') Between
Polygon-Surface Patch And Pixel-Ray R Pixel
In System R (x',y',z') PLIIM/Cartesian
Coordinate Transformation
P(x',y',z')
Polygon-Surface Patch
SI(x',y',z'),R PLIIM/Cartesian
P(x',y',z')
Polygon-Surface Patch
SI(x,y,z), R LDIP/Cartesian
Linear CCD Array Capturing High Resolution Linear 2-D Image each Photo-integration Time Period
Area-Type 3-D Surface Map Of Arbitrary 3-D Object Surface

FIG. 23B

METHOD OF AND APPARATUS FOR PERFORMING AUTOMATIC RECOGNITION OF GRAPHICAL INTELLIGENCE CONTAINED IN 2-D IMAGES CAPTURED FROM ARBITARY 3-D OBJECT SURFACES

STEP 1: At the unitary PLIIM-based object imaging and profiling system, use the laser doppler imaging and profiling (LDIP) subsystem employed therein to (i) consecutively capture a series of linear 3-D surface profile maps on a targeted arbitrary (e.g. non-planar or planar) 3-D object surface bearing forms of graphical intelligence and (ii) measure the velocity of the arbitrary 3-D object surface, wherein the polar coordinates of each point in the captured linear 3-D surface profile map are specified in a local polar coordinate system $R_{LDIP/polar}$, symbolically embedded within the LDIP subsystem. — A

STEP 2: At the unitary PLIIM-based object imaging and profiling system, use coordinate transforms to automatically convert the polar coordinates of each point $p(\alpha, R)$ in the captured linear 3-D surface profile map into x,y, z Cartesian coordinates specified as p(x,y,z) in a local Cartesian coordinate system $R_{LDIP/Cartesian}$, symbolically embedded within the LDIP subsystem. — B

STEP 3: At the unitary PLIIM-based object imaging and profiling system, use the PLIIM-based imager employed therein to consecutively capture high-resolution linear 2-D images of the arbitrary 3-D object surface bearing forms of graphical intelligence (e.g. symbol character strings), wherein (i) the x', y' coordinates of each pixel in each said captured high-resolution linear 2-D image is specified in local Cartesian coordinate system $R_{PLIIM/Cartesian}$ symbolically embedded within the PLIIM-based imager, and (ii) the intensity value of the pixel I(x',y') is associated with the x', y' Cartesian coordinates of the image detection element in the linear image detection array at which the pixel is detected, and (iii) wherein also the planar laser illumination beam (PLIB) of the PLIIM-based imager is spaced from the amplitude modulated (AM) laser scanning beam of the LDIP subsystem is about D centimeters. — C

(A)

FIG. 23C1

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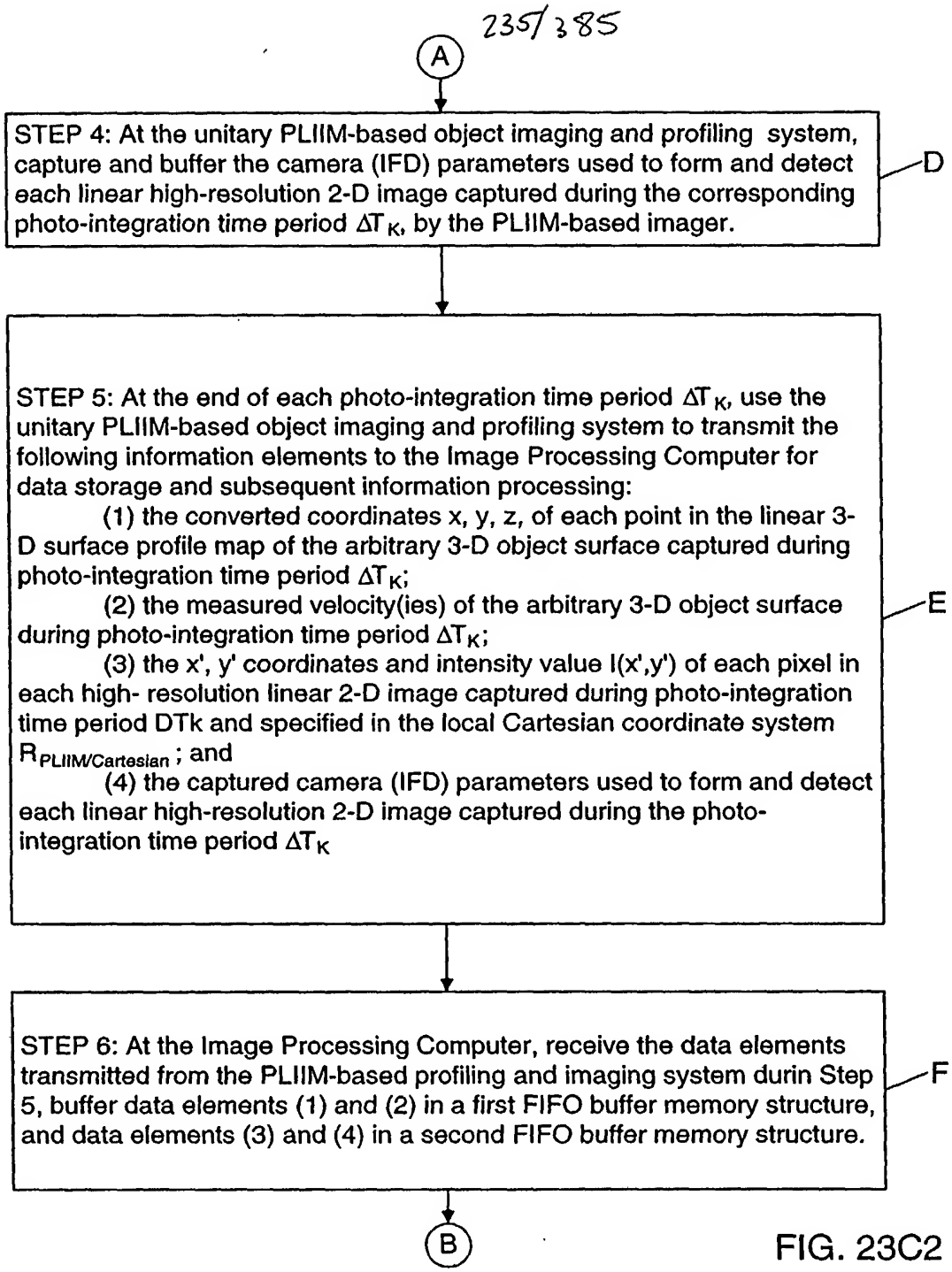

FIG. 23C2

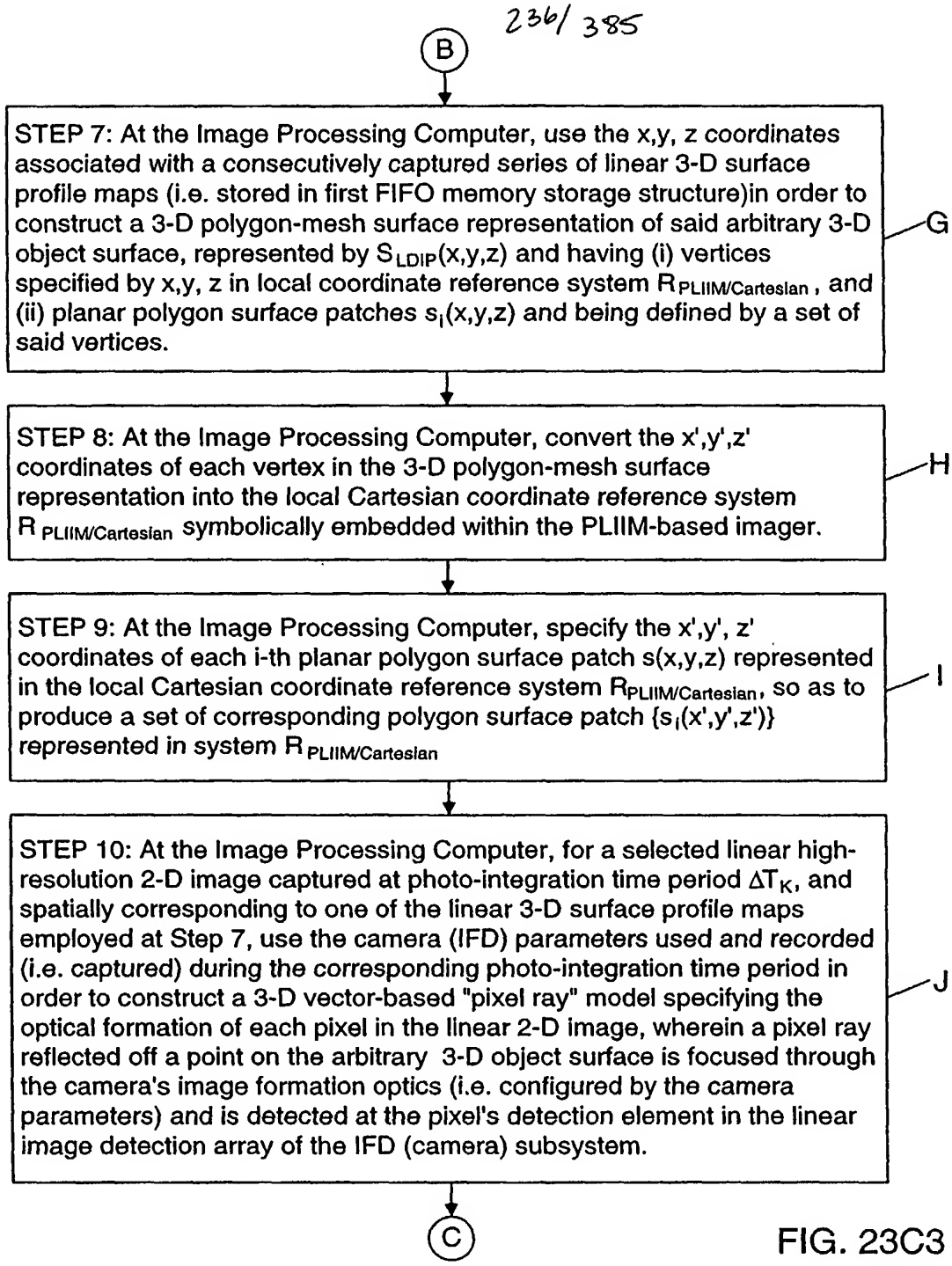
B
STEP 7: At the Image Processing Computer, use the x,y, z coordinates associated with a consecutively captured series of linear 3-D surface profile maps (i.e. stored in first FIFO memory storage structure)in order to construct a 3-D polygon-mesh surface representation of said arbitrary 3-D object surface, represented by $S_{LDIP}(x,y,z)$ and having (i) vertices specified by x,y, z in local coordinate reference system $R_{PLIIM/Cartesian}$, and (ii) planar polygon surface patches $s_i(x,y,z)$ and being defined by a set of said vertices.
G
STEP 8: At the Image Processing Computer, convert the x',y',z' coordinates of each vertex in the 3-D polygon-mesh surface representation into the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$ symbolically embedded within the PLIIM-based imager.
H
STEP 9: At the Image Processing Computer, specify the x',y', z' coordinates of each i-th planar polygon surface patch s(x,y,z) represented in the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$, so as to produce a set of corresponding polygon surface patch $\{s_i(x',y',z')\}$ represented in system $R_{PLIIM/Cartesian}$
I
STEP 10: At the Image Processing Computer, for a selected linear high-resolution 2-D image captured at photo-integration time period ΔT_K, and spatially corresponding to one of the linear 3-D surface profile maps employed at Step 7, use the camera (IFD) parameters used and recorded (i.e. captured) during the corresponding photo-integration time period in order to construct a 3-D vector-based "pixel ray" model specifying the optical formation of each pixel in the linear 2-D image, wherein a pixel ray reflected off a point on the arbitrary 3-D object surface is focused through the camera's image formation optics (i.e. configured by the camera parameters) and is detected at the pixel's detection element in the linear image detection array of the IFD (camera) subsystem.
J
C

FIG. 23C3

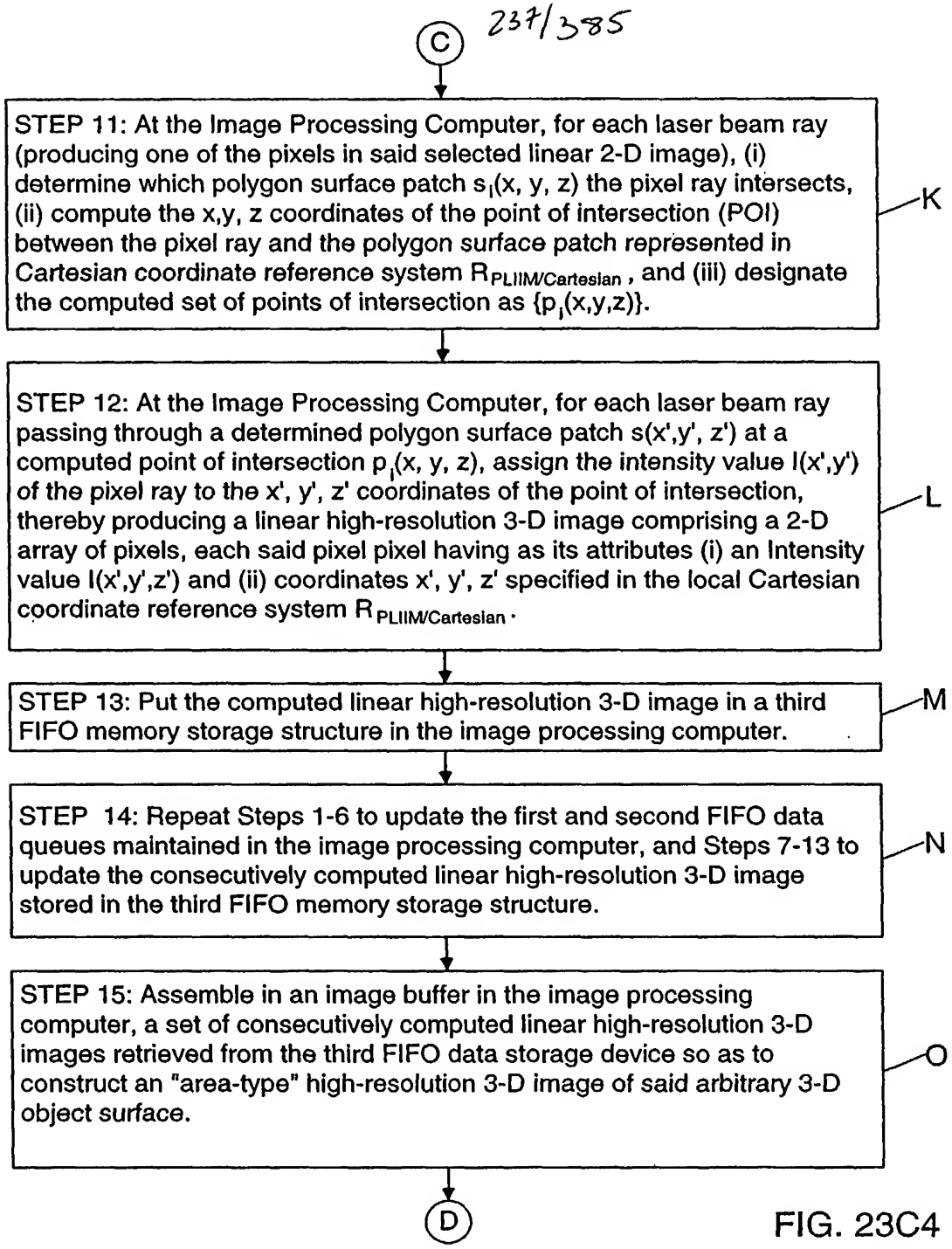
C
STEP 11: At the Image Processing Computer, for each laser beam ray (producing one of the pixels in said selected linear 2-D image), (i) determine which polygon surface patch $s_i(x, y, z)$ the pixel ray intersects, (ii) compute the x,y, z coordinates of the point of intersection (POI) between the pixel ray and the polygon surface patch represented in Cartesian coordinate reference system $R_{PLIIM/Cartesian}$, and (iii) designate the computed set of points of intersection as $\{p_i(x,y,z)\}$.
K
STEP 12: At the Image Processing Computer, for each laser beam ray passing through a determined polygon surface patch s(x',y', z') at a computed point of intersection $p_i(x, y, z)$, assign the intensity value I(x',y') of the pixel ray to the x', y', z' coordinates of the point of intersection, thereby producing a linear high-resolution 3-D image comprising a 2-D array of pixels, each said pixel pixel having as its attributes (i) an Intensity value I(x',y',z') and (ii) coordinates x', y', z' specified in the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$.
L
STEP 13: Put the computed linear high-resolution 3-D image in a third FIFO memory storage structure in the image processing computer.
M
STEP 14: Repeat Steps 1-6 to update the first and second FIFO data queues maintained in the image processing computer, and Steps 7-13 to update the consecutively computed linear high-resolution 3-D image stored in the third FIFO memory storage structure.
N
STEP 15: Assemble in an image buffer in the image processing computer, a set of consecutively computed linear high-resolution 3-D images retrieved from the third FIFO data storage device so as to construct an "area-type" high-resolution 3-D image of said arbitrary 3-D object surface.
O
D

FIG. 23C4

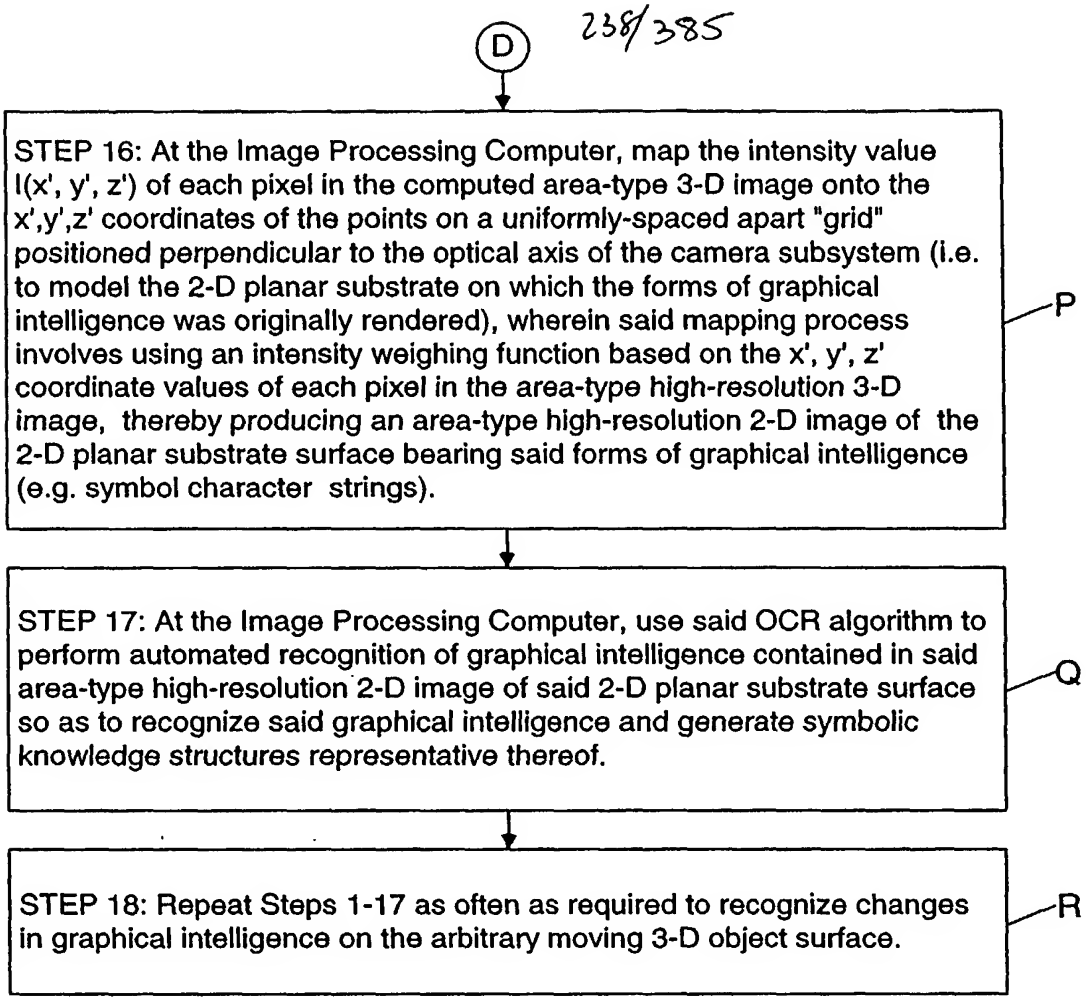
D
STEP 16: At the Image Processing Computer, map the intensity value I(x', y', z') of each pixel in the computed area-type 3-D image onto the x',y',z' coordinates of the points on a uniformly-spaced apart "grid" positioned perpendicular to the optical axis of the camera subsystem (i.e. to model the 2-D planar substrate on which the forms of graphical intelligence was originally rendered), wherein said mapping process involves using an intensity weighing function based on the x', y', z' coordinate values of each pixel in the area-type high-resolution 3-D image, thereby producing an area-type high-resolution 2-D image of the 2-D planar substrate surface bearing said forms of graphical intelligence (e.g. symbol character strings).
P
STEP 17: At the Image Processing Computer, use said OCR algorithm to perform automated recognition of graphical intelligence contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical intelligence and generate symbolic knowledge structures representative thereof.
Q
STEP 18: Repeat Steps 1-17 as often as required to recognize changes in graphical intelligence on the arbitrary moving 3-D object surface.
R

FIG. 23C5

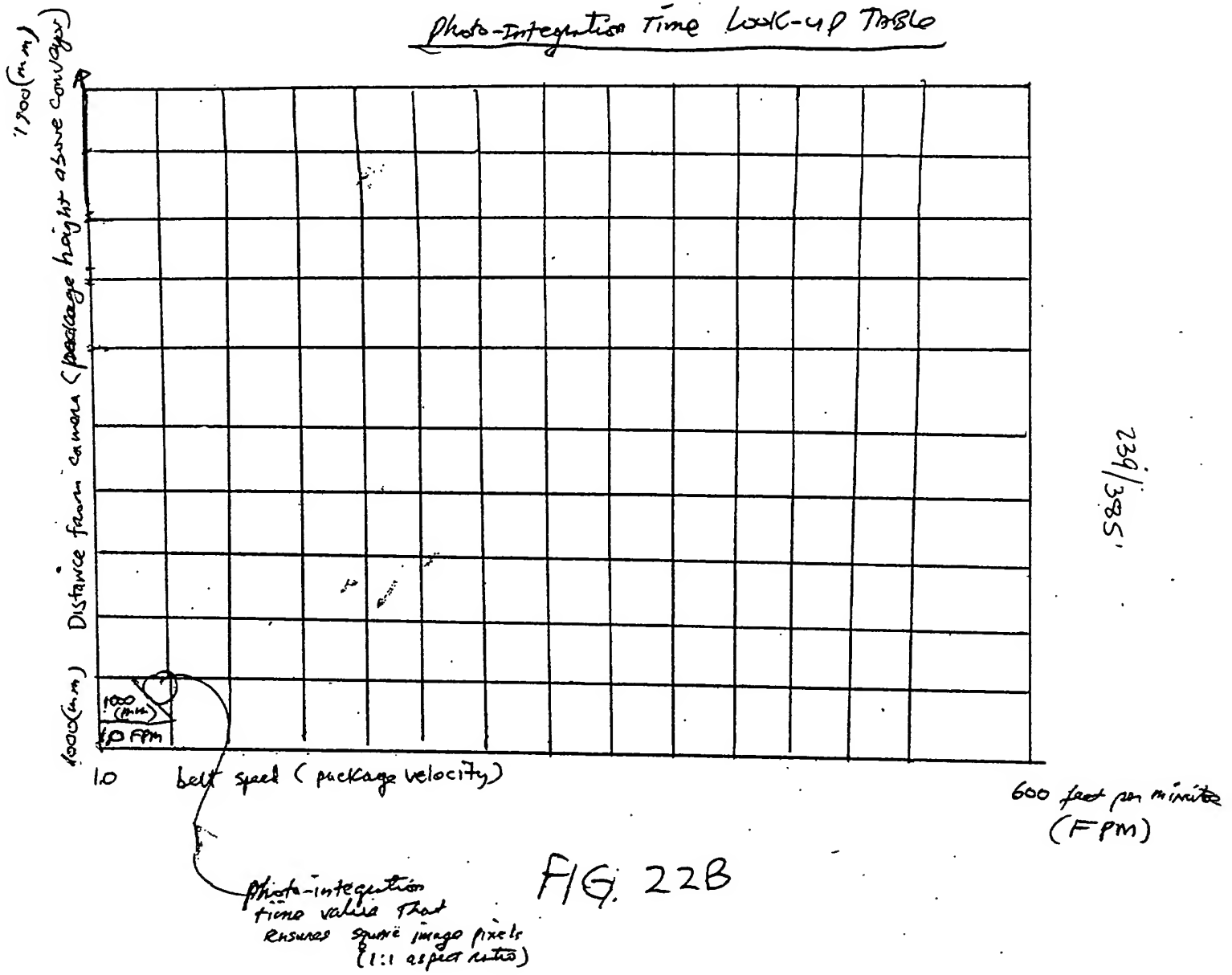

FIG. 22B

239/385

20070226220 "22607 PCT/US2006/009015

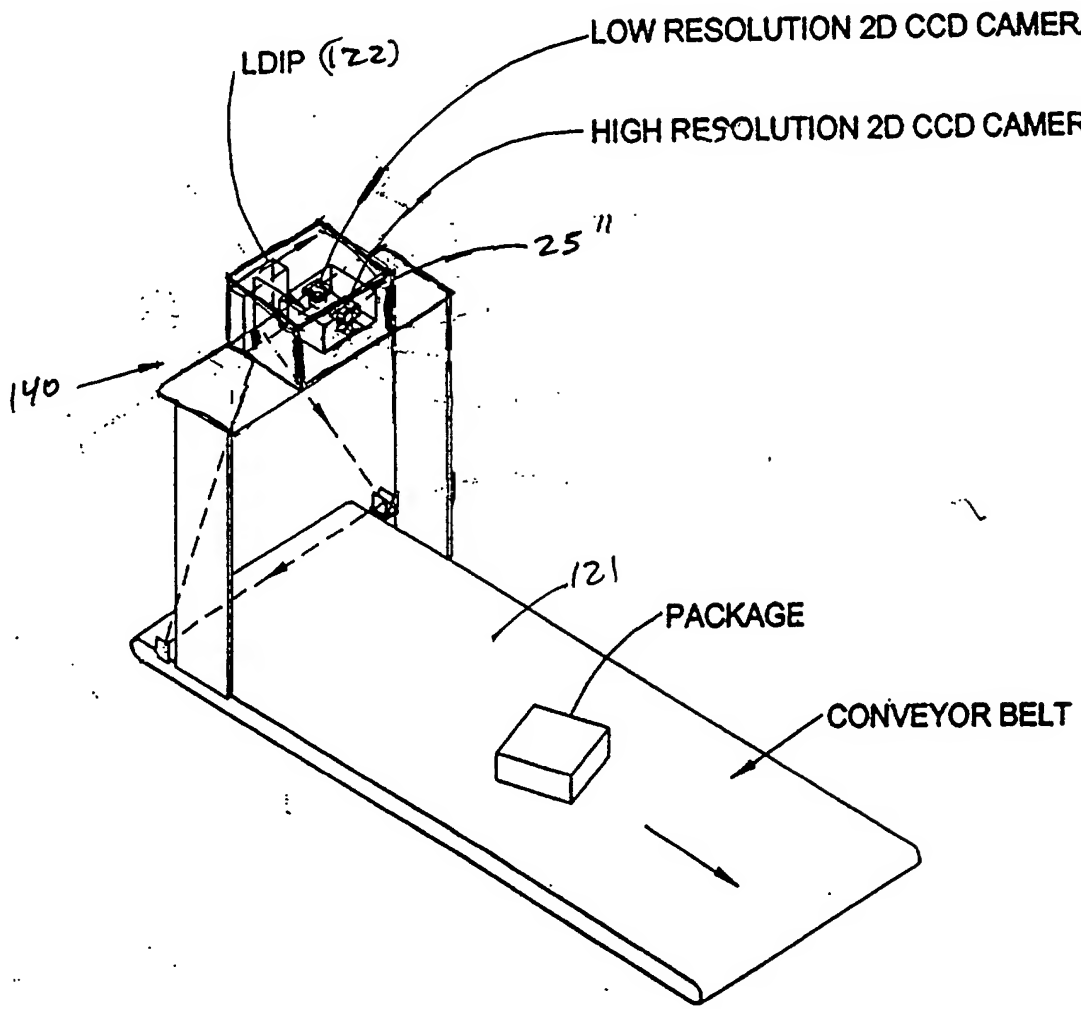

FIG 24

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EP 1 600 892 A2 30-11-2005

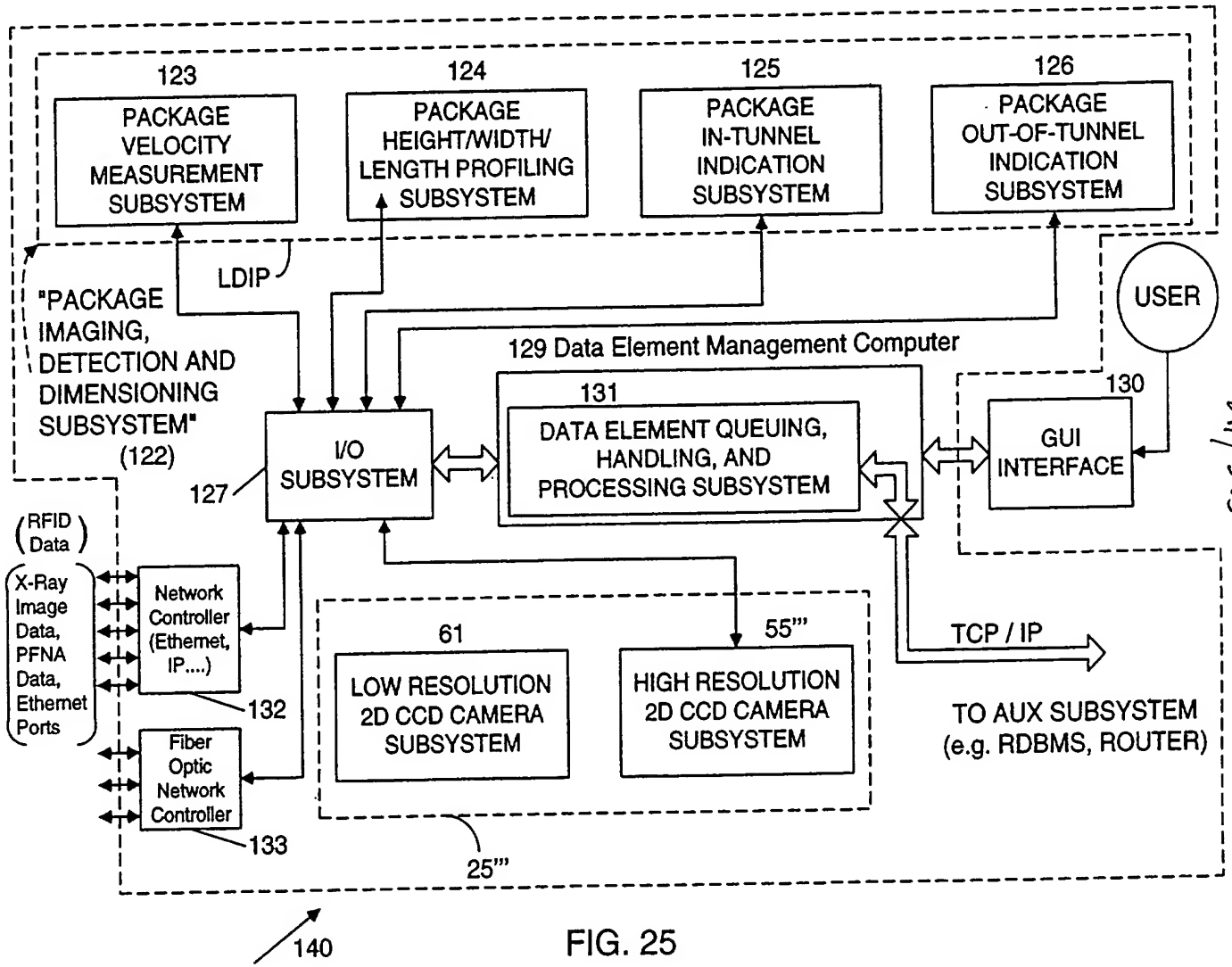
123
PACKAGE VELOCITY MEASUREMENT SUBSYSTEM
124
PACKAGE HEIGHT/WIDTH/ LENGTH PROFILING SUBSYSTEM
125
PACKAGE IN-TUNNEL INDICATION SUBSYSTEM
126
PACKAGE OUT-OF-TUNNEL INDICATION SUBSYSTEM
LDIP
"PACKAGE IMAGING, DETECTION AND DIMENSIONING SUBSYSTEM" (122)
USER
129 Data Element Management Computer
131
DATA ELEMENT QUEUING, HANDLING, AND PROCESSING SUBSYSTEM
130
GUI INTERFACE
127
I/O SUBSYSTEM
(RFID Data)
X-Ray Image Data, PFNA Data, Ethernet Ports
Network Controller (Ethernet, IP....)
132
Fiber Optic Network Controller
133
61
LOW RESOLUTION 2D CCD CAMERA SUBSYSTEM
55'''
HIGH RESOLUTION 2D CCD CAMERA SUBSYSTEM
TCP / IP
TO AUX SUBSYSTEM (e.g. RDBMS, ROUTER)
25'''
140

FIG. 25

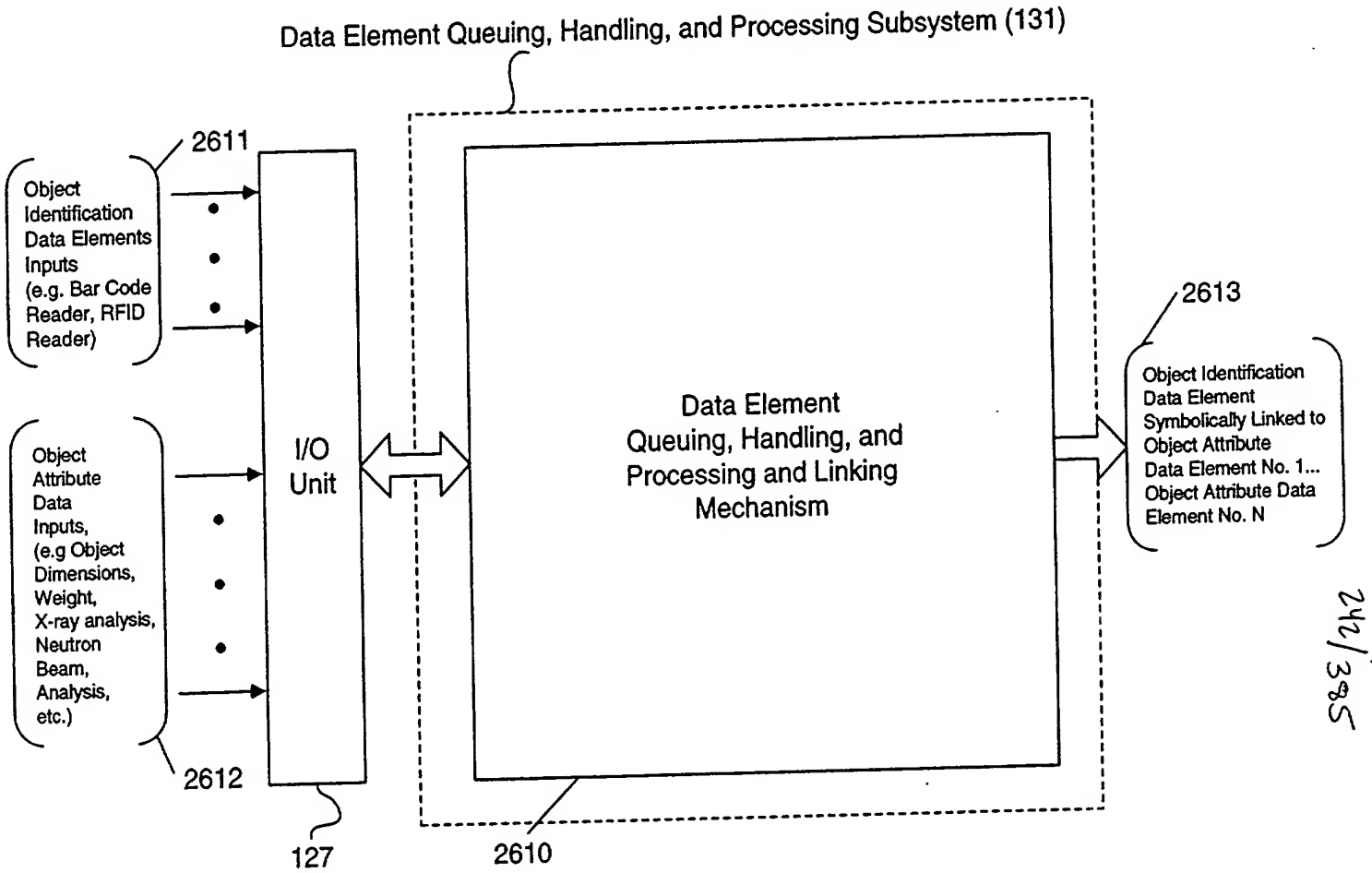

FIG. 25A

242/385

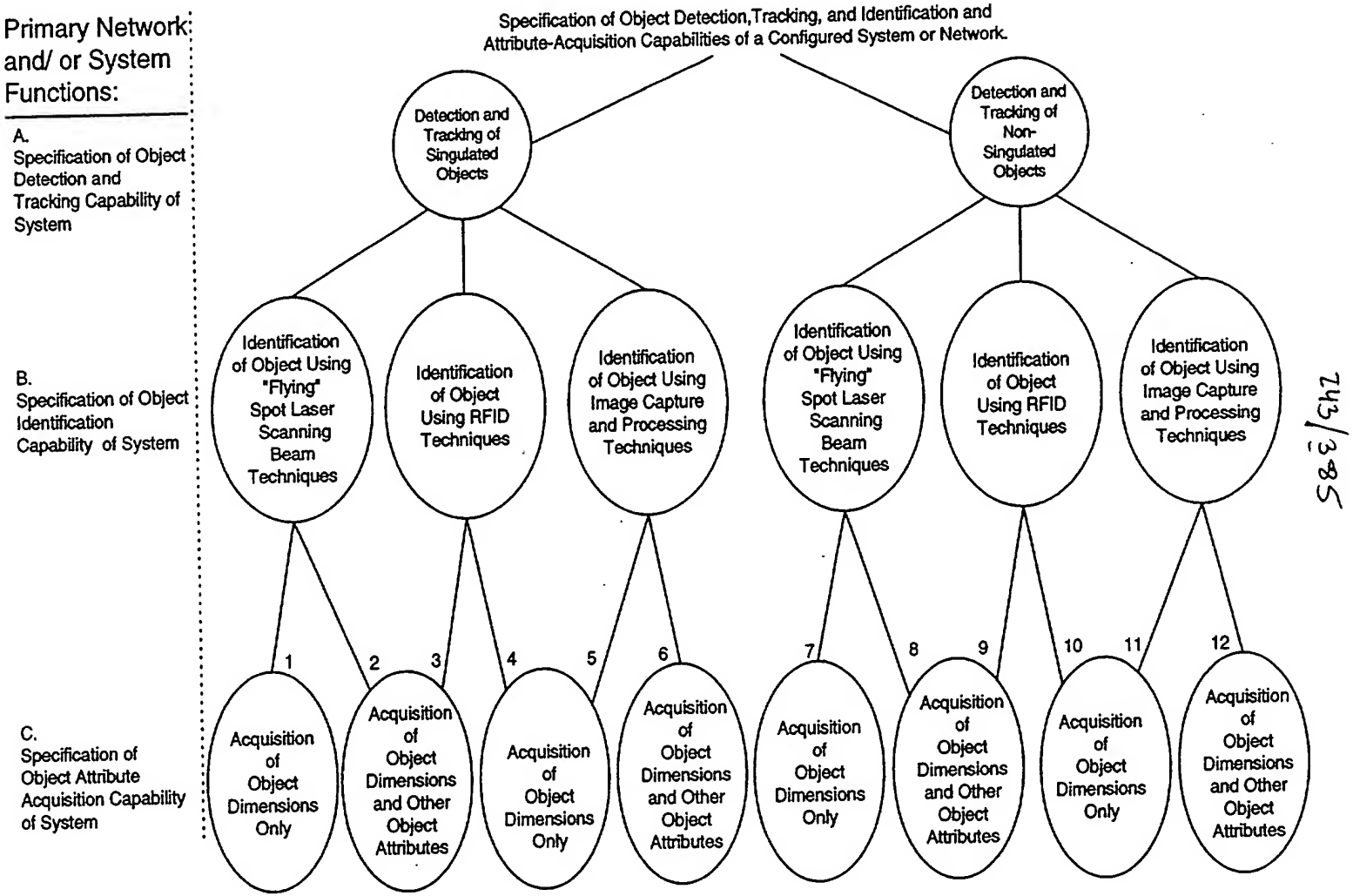

FIG. 25B

743/385

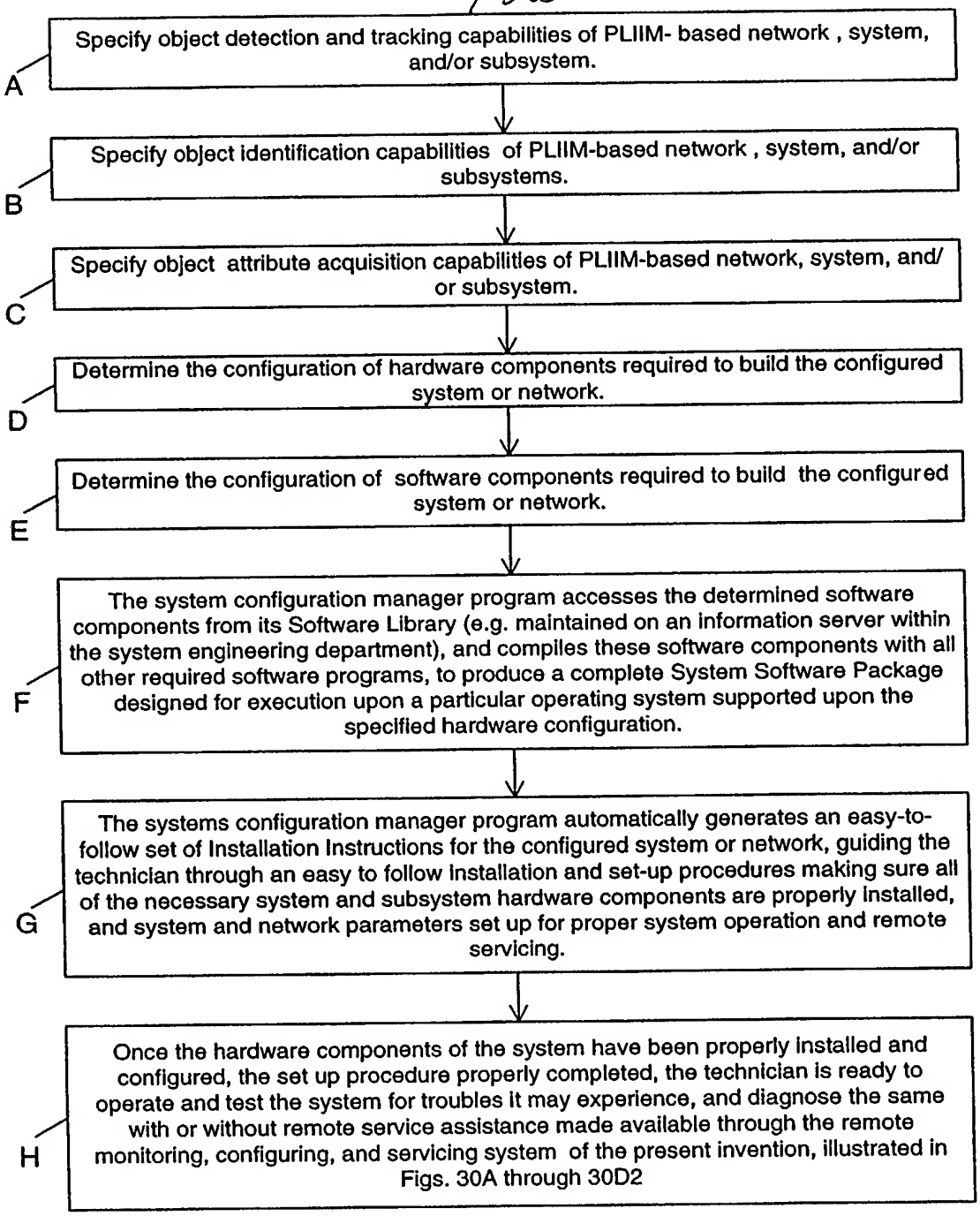
A
Specify object detection and tracking capabilities of PLIIM- based network , system, and/or subsystem.
B
Specify object identification capabilities of PLIIM-based network , system, and/or subsystems.
C
Specify object attribute acquisition capabilities of PLIIM-based network, system, and/or subsystem.
D
Determine the configuration of hardware components required to build the configured system or network.
E
Determine the configuration of software components required to build the configured system or network.
F
The system configuration manager program accesses the determined software components from its Software Library (e.g. maintained on an information server within the system engineering department), and compiles these software components with all other required software programs, to produce a complete System Software Package designed for execution upon a particular operating system supported upon the specified hardware configuration.
G
The systems configuration manager program automatically generates an easy-to-follow set of Installation Instructions for the configured system or network, guiding the technician through an easy to follow installation and set-up procedures making sure all of the necessary system and subsystem hardware components are properly installed, and system and network parameters set up for proper system operation and remote servicing.
H
Once the hardware components of the system have been properly installed and configured, the set up procedure properly completed, the technician is ready to operate and test the system for troubles it may experience, and diagnose the same with or without remote service assistance made available through the remote monitoring, configuring, and servicing system of the present invention, illustrated in Figs. 30A through 30D2

FIG. 25C

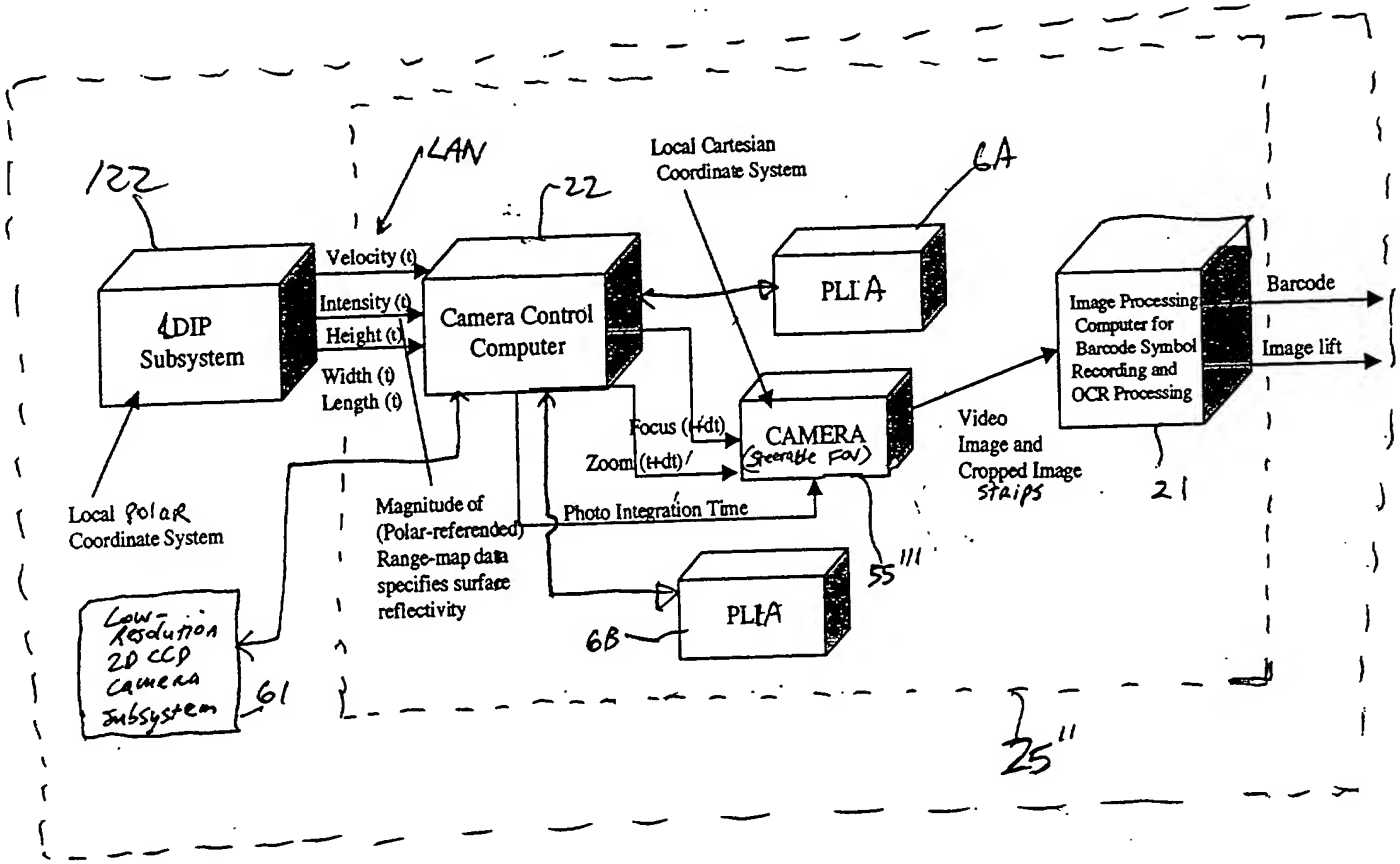
122
LAN
22
Local Cartesian Coordinate System
6A
LDIP Subsystem
Velocity (t)
Intensity (t)
Height (t)
Width (t)
Length (t)
Camera Control Computer
PLIA
Image Processing Computer for Barcode Symbol Recording and OCR Processing
Barcode
Image lift
Focus (t+dt)
Zoom (t+dt)
CAMERA (steerable FOV)
Video Image and Cropped Image strips
21
Local Polar Coordinate System
Magnitude of (Polar-referenced) Range-map data specifies surface reflectivity
Photo Integration Time
55
111
PLIA
6B
Low-Resolution 2D CCD Camera Subsystem
61
25''
2451385

FIG. 26

140

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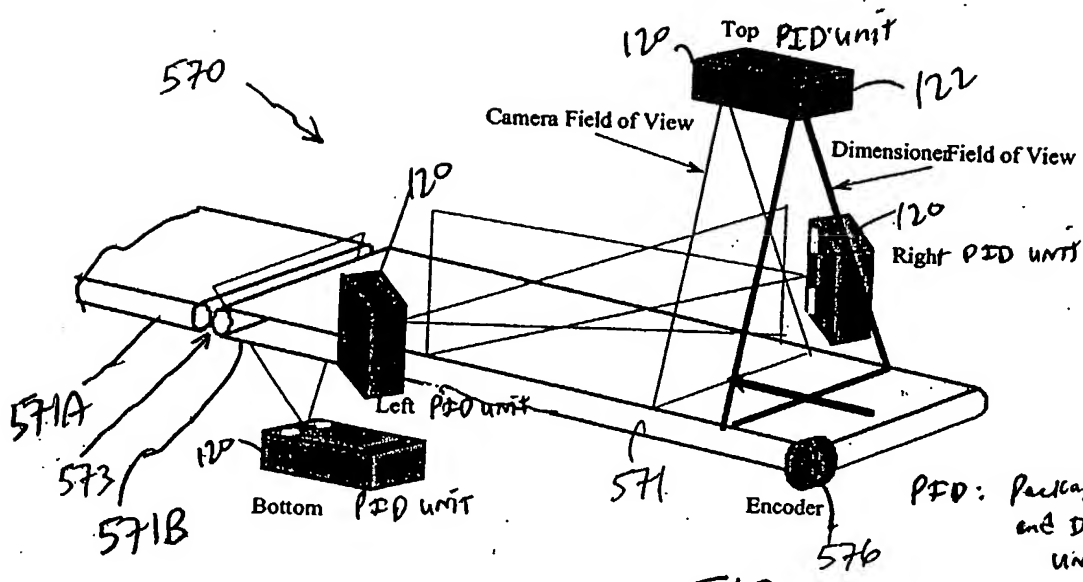

FIG. 27

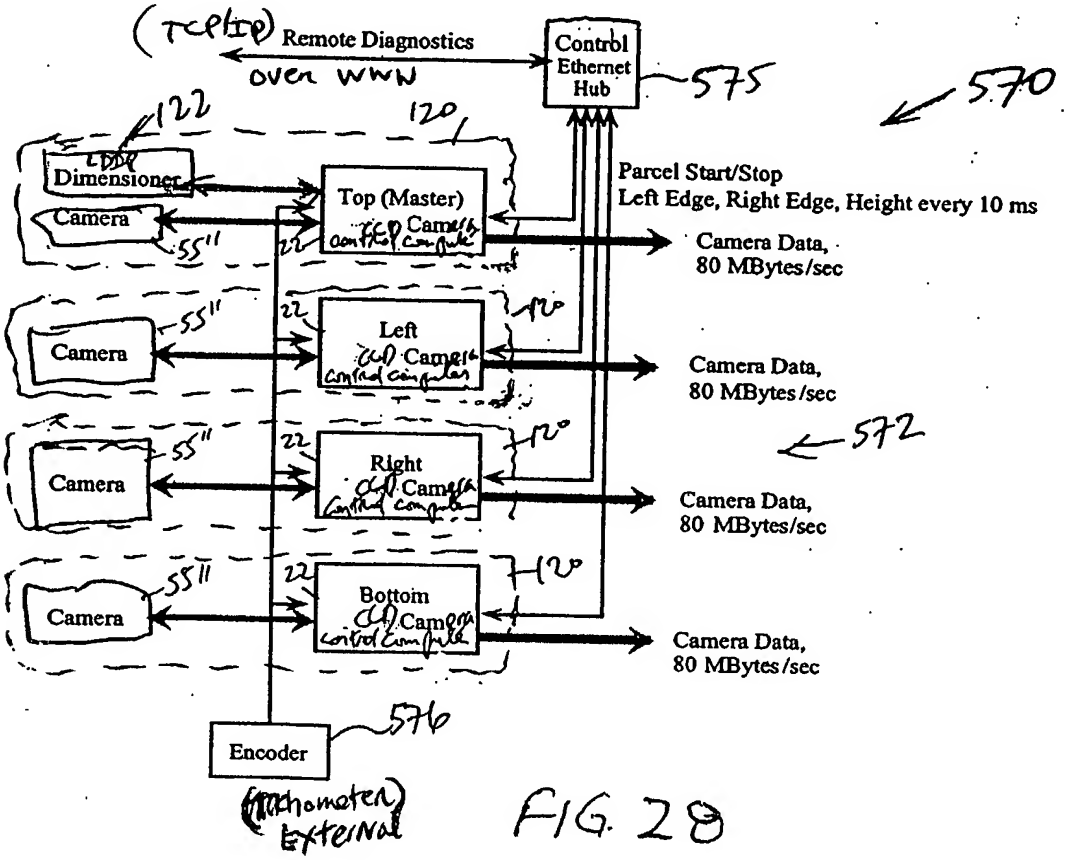

FIG. 28

247/385)

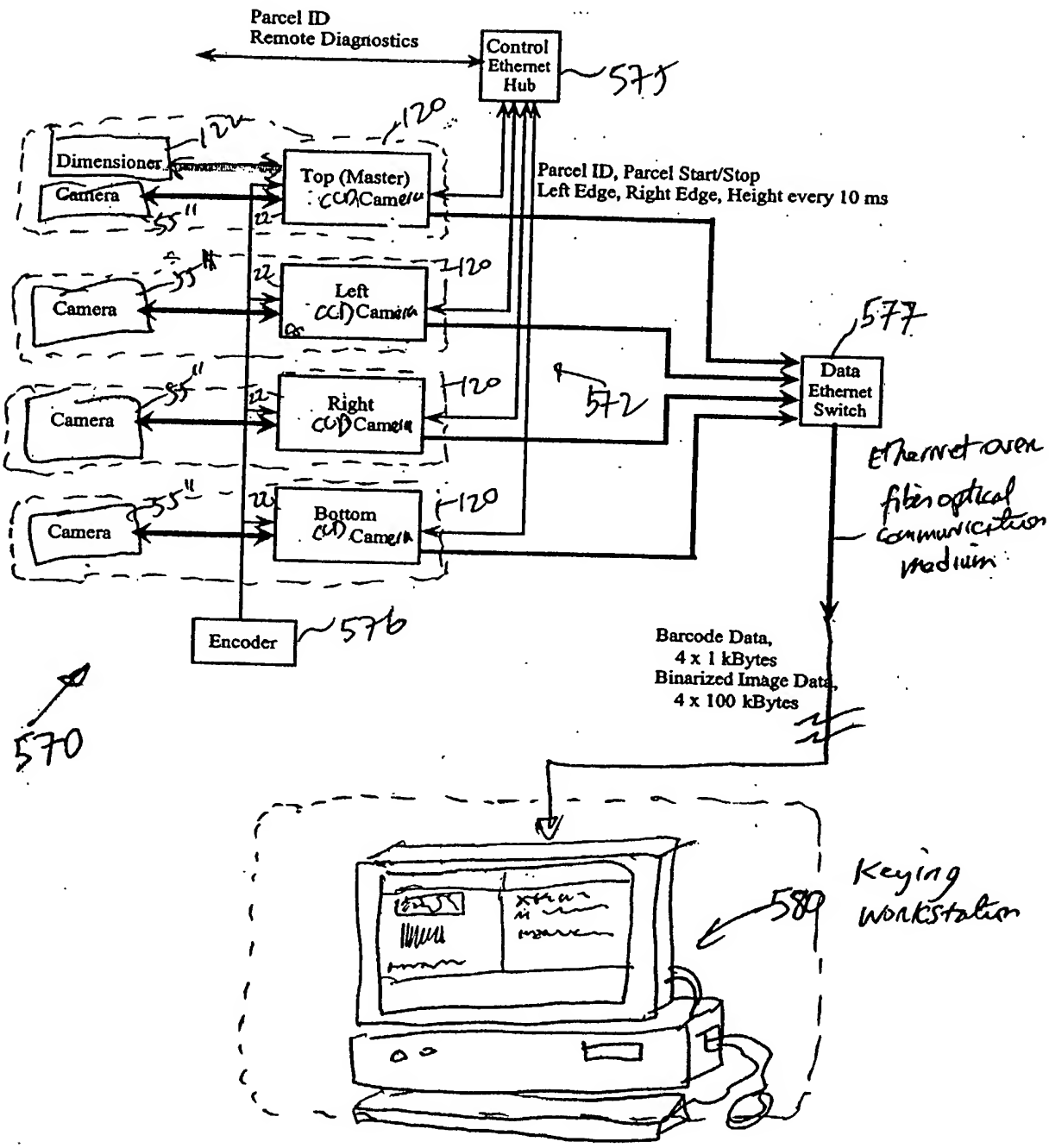

FIG. 29

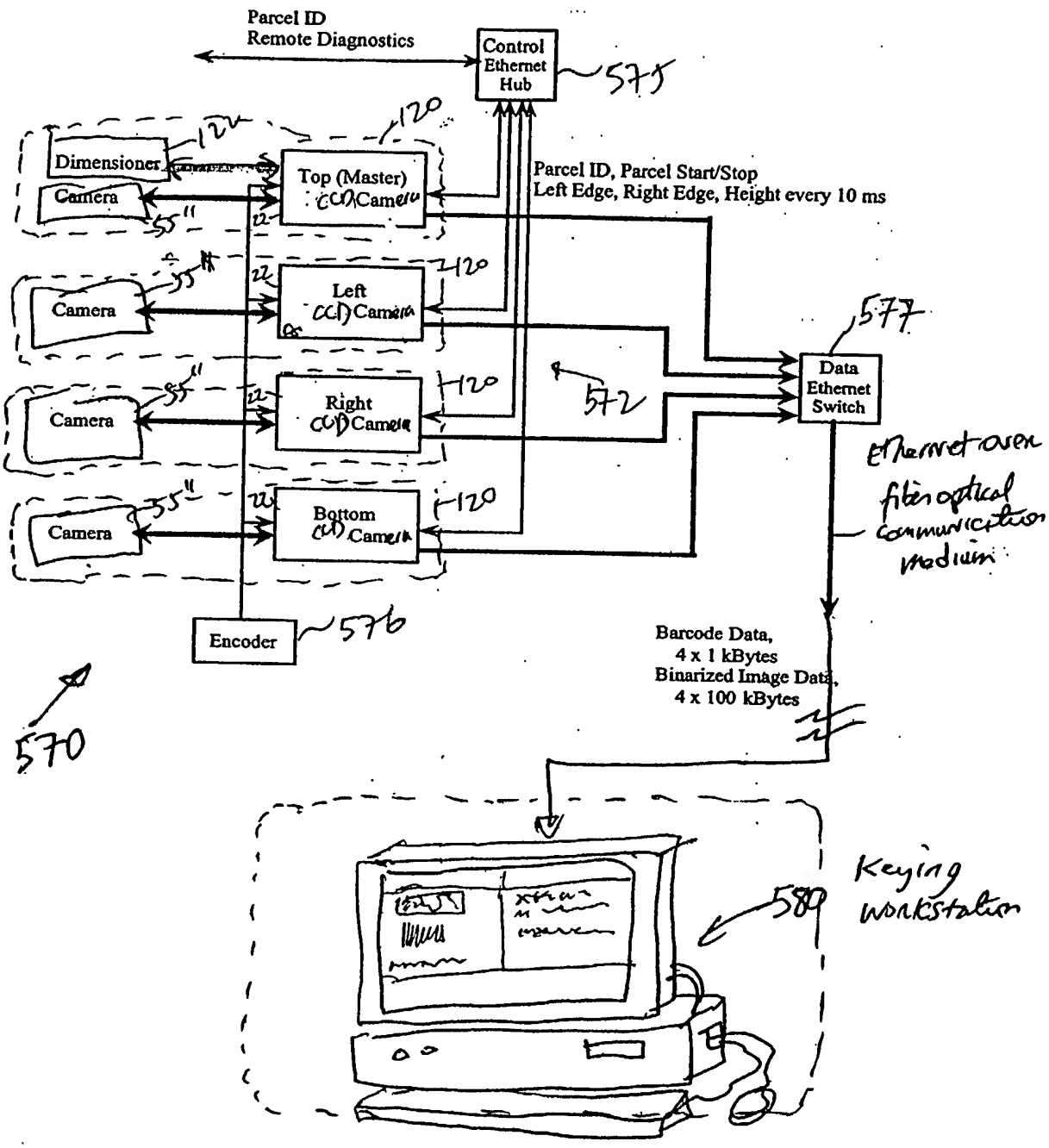
Parcel ID
Remote Diagnostics
Control Ethernet Hub
575
Dimensioner
Camera
Top (Master) CCD Camera
120
Parcel ID, Parcel Start/Stop
Left Edge, Right Edge, Height every 10 ms
Camera
Left CCD Camera
Camera
Right CCD Camera
Camera
Bottom CCD Camera
Encoder
576
572
577
Data Ethernet Switch
Ethernet over fiber optical communication medium
Barcode Data,
4 x 1 kBytes
Binarized Image Data,
4 x 100 kBytes
570
580
Keying Workstation

FIG. 29

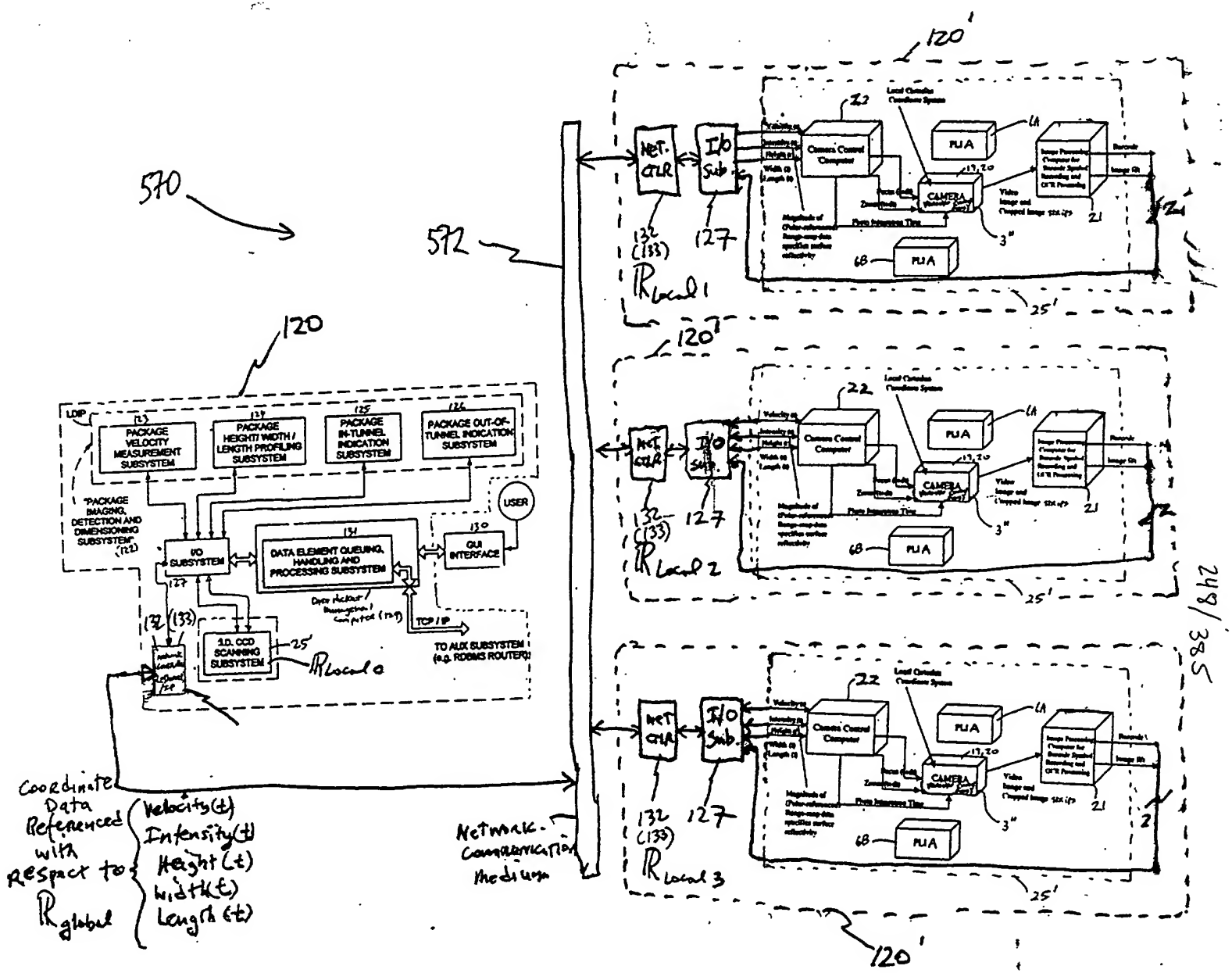

FIG 30

20020220.2289.0001

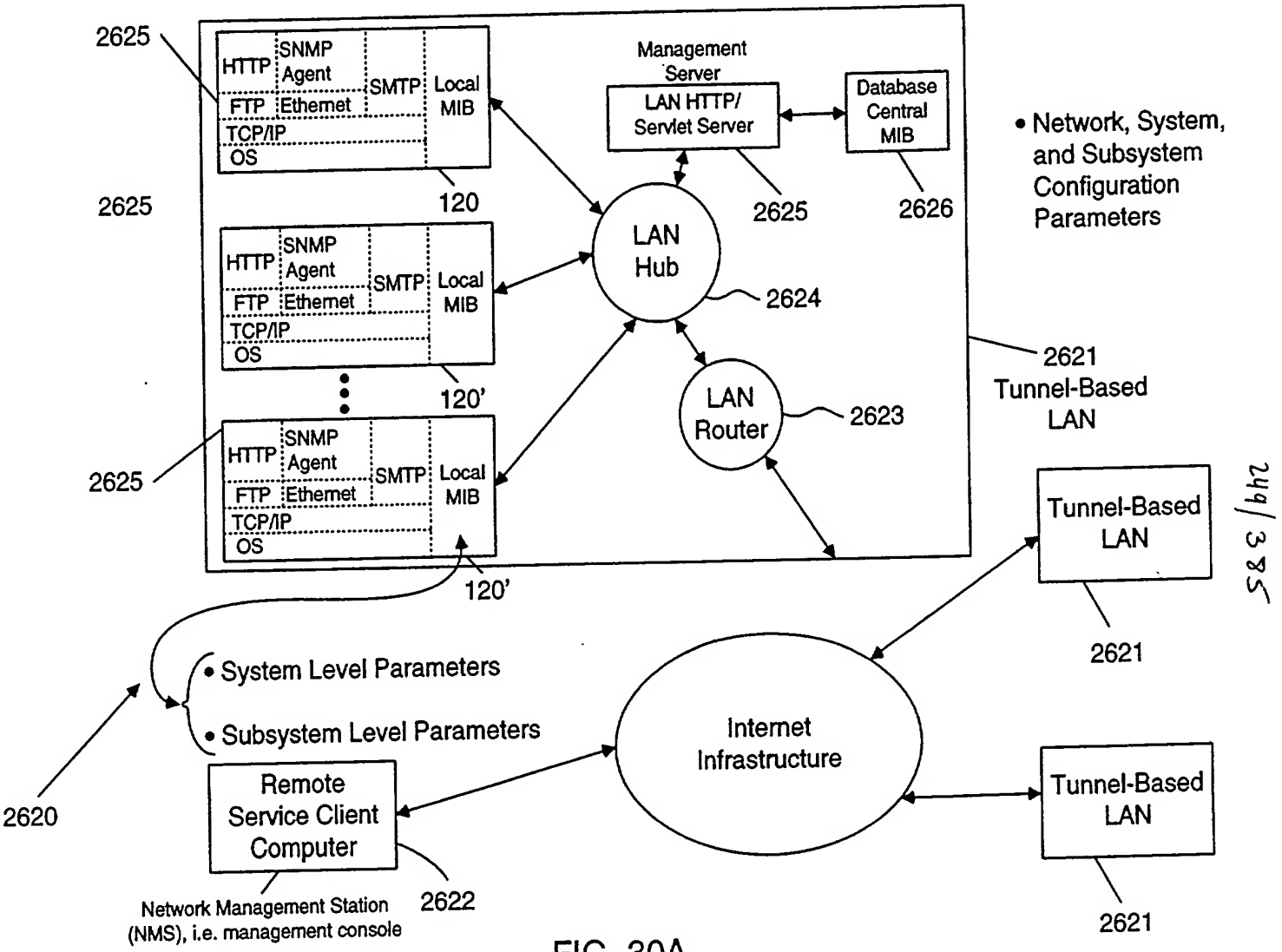
2625
HTTP
SNMP Agent
SMTP
Local MIB
FTP
Ethernet
TCP/IP
OS
120
2625
120'
2625
120'
Management Server
LAN HTTP/ Servlet Server
Database Central MIB
2625
2626
LAN Hub
2624
LAN Router
2623
2621 Tunnel-Based LAN
• Network, System, and Subsystem Configuration Parameters
Tunnel-Based LAN
2621
• System Level Parameters
• Subsystem Level Parameters
2620
Remote Service Client Computer
2622
Network Management Station (NMS), i.e. management console
Internet Infrastructure
Tunnel-Based LAN
2621

FIG. 30A

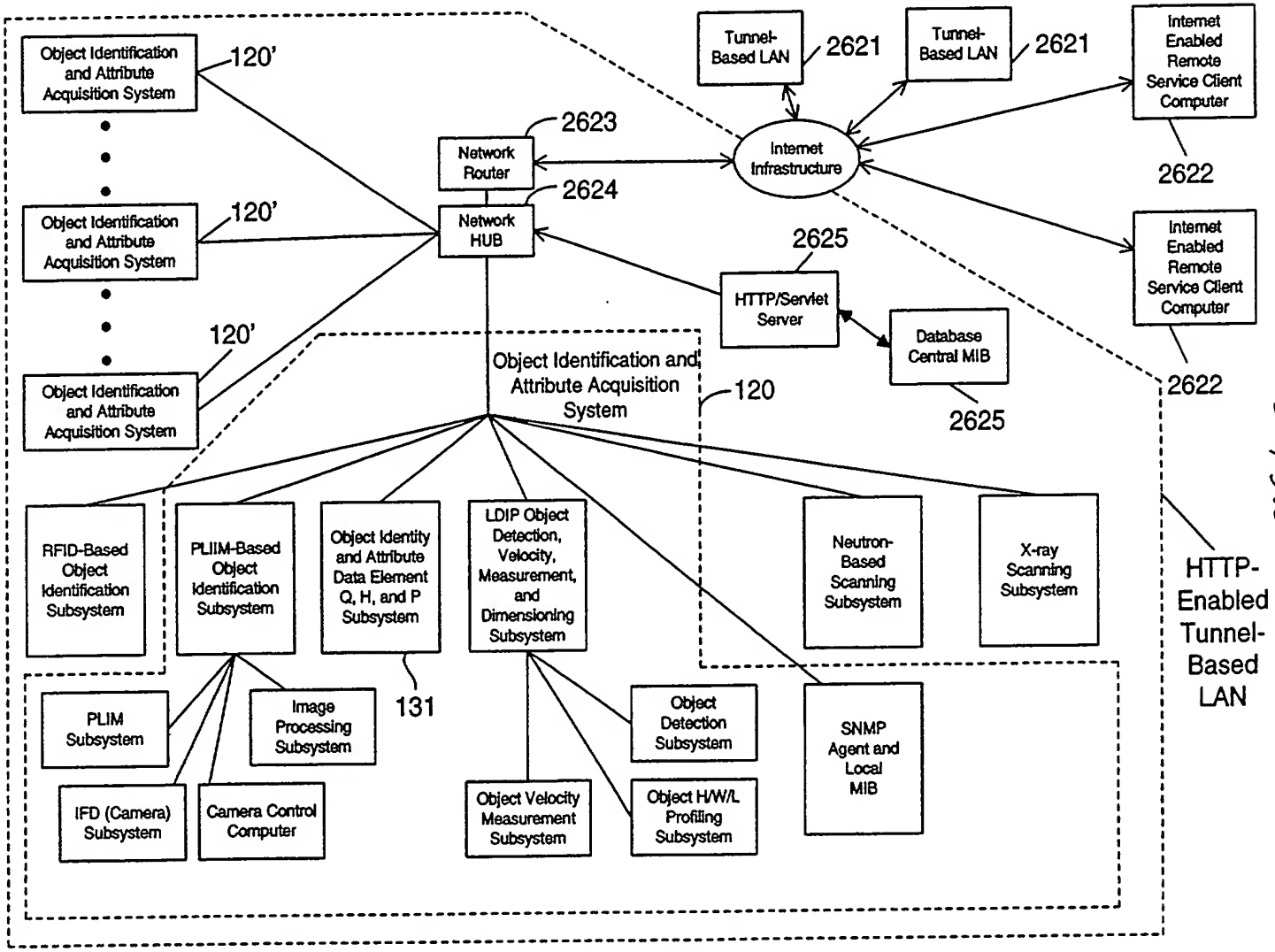

FIG. 30B

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Network Configuration Parameters:

[Router IP address; no. of nodes (i.e. systems) in LAN; passwords, LAN location; name of customer facility; technical contact; phone no.; domain name; object identity codes; object attribute acquisition codes;.....]

System Configuration Parameters:

[System IP Address; passwords; object identity codes; object attribute acquisition codes;....]

Monitorable and/or Configurable Parameters for Subsystems Within Each System:

These subsystems generate object identity parameters

- ☐ PLIIM-based object identification subsystem: [object identity code; object attribute acquisition codes;....]
  - ☐ PLIM Subsystem: [VLD status; power VLD; TIM function; temp.;....]
  - ☐ IFD (Camera) Subsystem: [sensor temp; .....]
  - ☐ Image Processing Subsystem (Computer): [processor load history; system up time; # of frames (pgs); barcode read rate; current line rate;....]
  - ☐ Camera Contact Subsystem (Computer): [number of frames dropped; number of focused zoom commands; number and kinds of motor control errors;....]

This system links object attribute data element parameters(i.e. object identity data element) to corresponding object identity parameters (i.e. object atrribute data element)

- ☐ RFID-based object identification subsystem: [....]
- ☐ Object identity and attribute data element queuing, handling and processing subsystem: [....]

These subsystems generate object attribute parameters

- ☐ LDIP object identification, velocity-measurement, and dimensioning subsystem: [....]
  - ☐ Object velocity measurement subsystem: [polygon RPM; polygon laser output X; channel X drift; channel X noise; trigger error events; instant lock reference drift; temperature]
  - ☐ Object H/W/L profiling subsystem
  - ☐ Object detection subsystem: [non- singulation/ singulation code;....]
- ☐ X-ray scanning subsystem: [....]
- ☐ Neutron-beam scanning subsystem: [....]

FIG. 30C

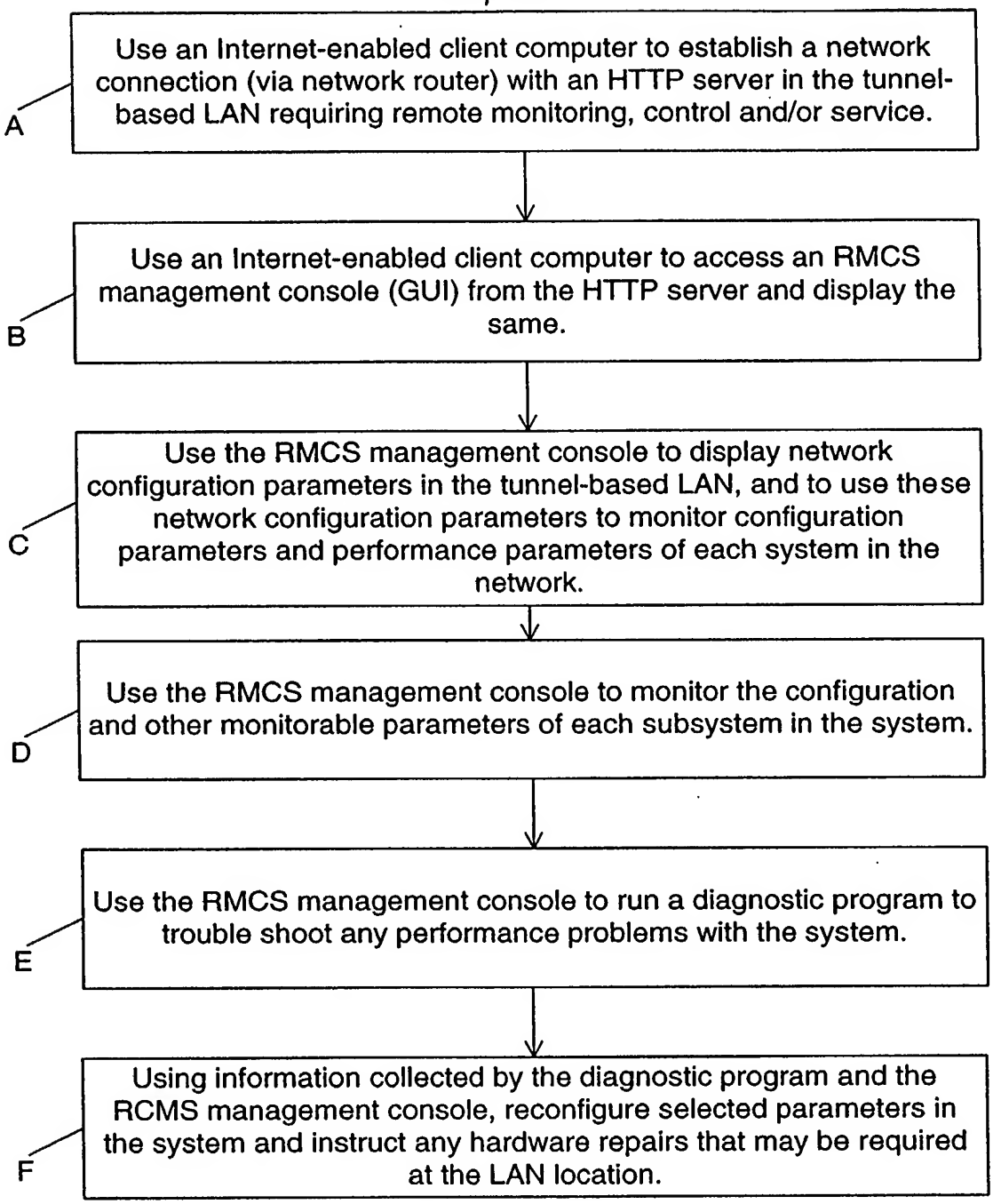
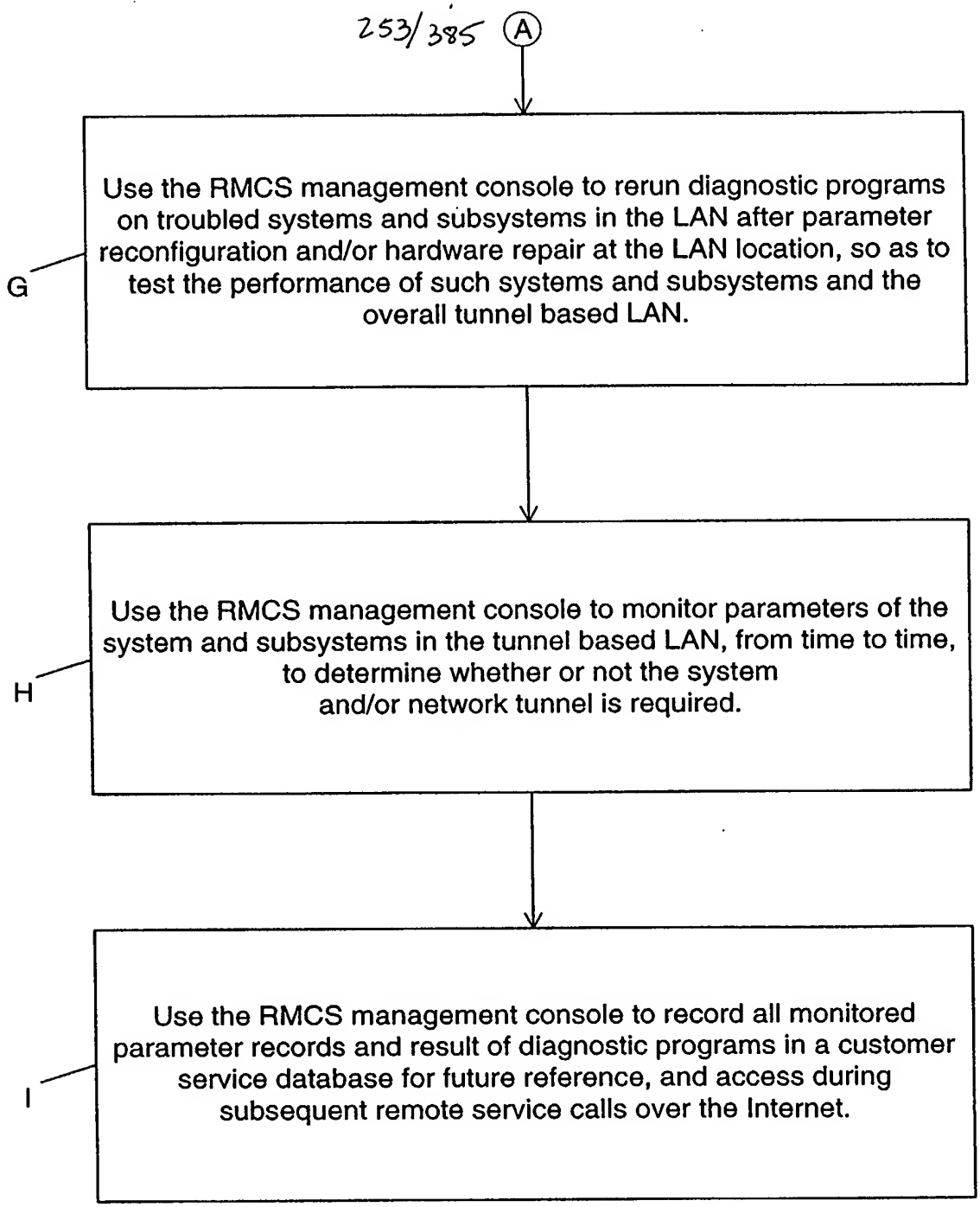

A
Use an Internet-enabled client computer to establish a network connection (via network router) with an HTTP server in the tunnel-based LAN requiring remote monitoring, control and/or service.
B
Use an Internet-enabled client computer to access an RMCS management console (GUI) from the HTTP server and display the same.
C
Use the RMCS management console to display network configuration parameters in the tunnel-based LAN, and to use these network configuration parameters to monitor configuration parameters and performance parameters of each system in the network.
D
Use the RMCS management console to monitor the configuration and other monitorable parameters of each subsystem in the system.
E
Use the RMCS management console to run a diagnostic program to trouble shoot any performance problems with the system.
F
Using information collected by the diagnostic program and the RCMS management console, reconfigure selected parameters in the system and instruct any hardware repairs that may be required at the LAN location.

FIG. 30D1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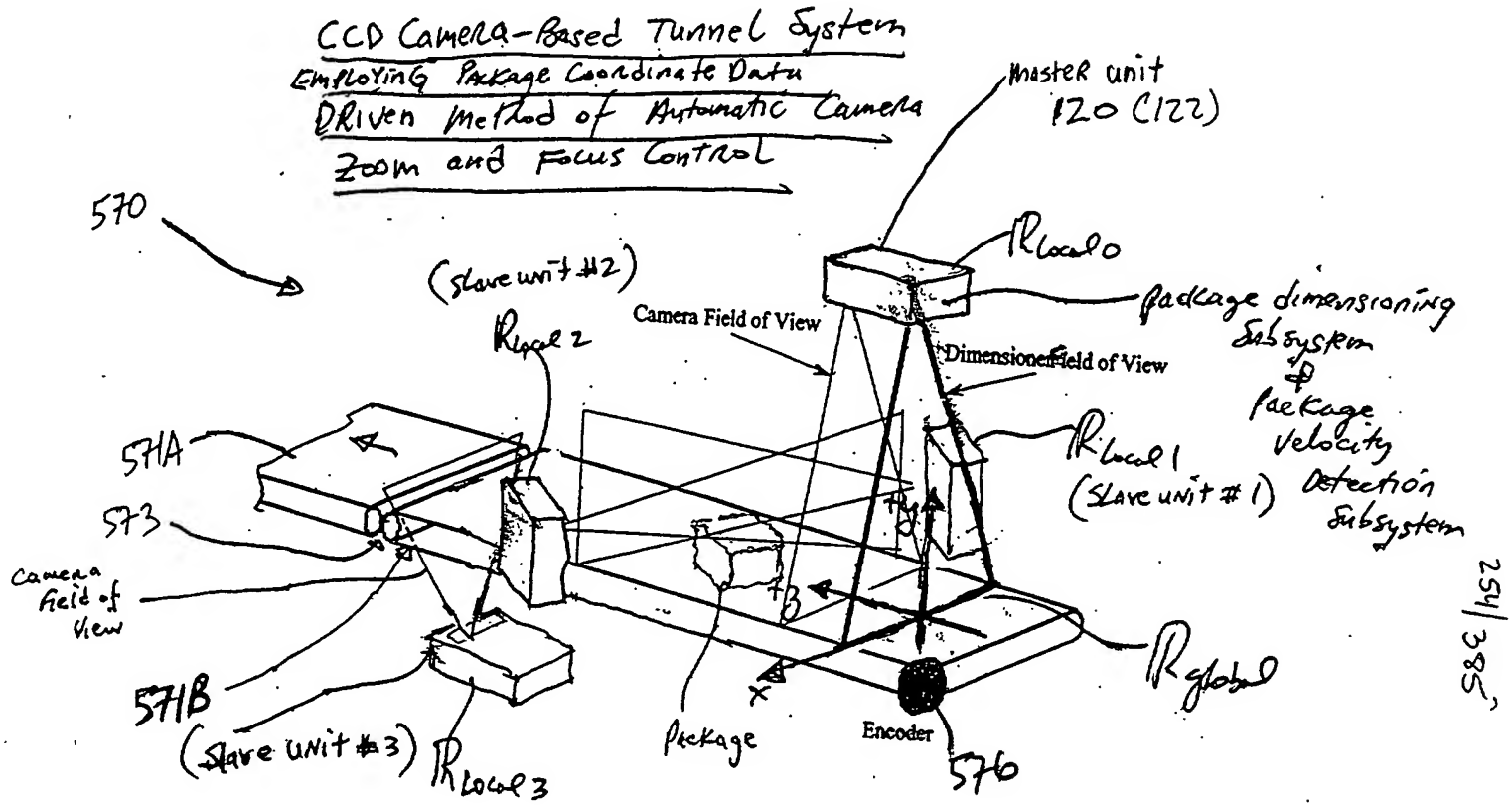
A
Use the RMCS management console to rerun diagnostic programs on troubled systems and subsystems in the LAN after parameter reconfiguration and/or hardware repair at the LAN location, so as to test the performance of such systems and subsystems and the overall tunnel based LAN.
G
Use the RMCS management console to monitor parameters of the system and subsystems in the tunnel based LAN, from time to time, to determine whether or not the system and/or network tunnel is required.
H
Use the RMCS management console to record all monitored parameter records and result of diagnostic programs in a customer service database for future reference, and access during subsequent remote service calls over the Internet.
I

FIG. 30D2



Package coordinate data $\|_{R_{global}}$ $\xrightarrow{HG}$ Package coordinate data $\|_{R_{local\,i}}$

FIG. 31

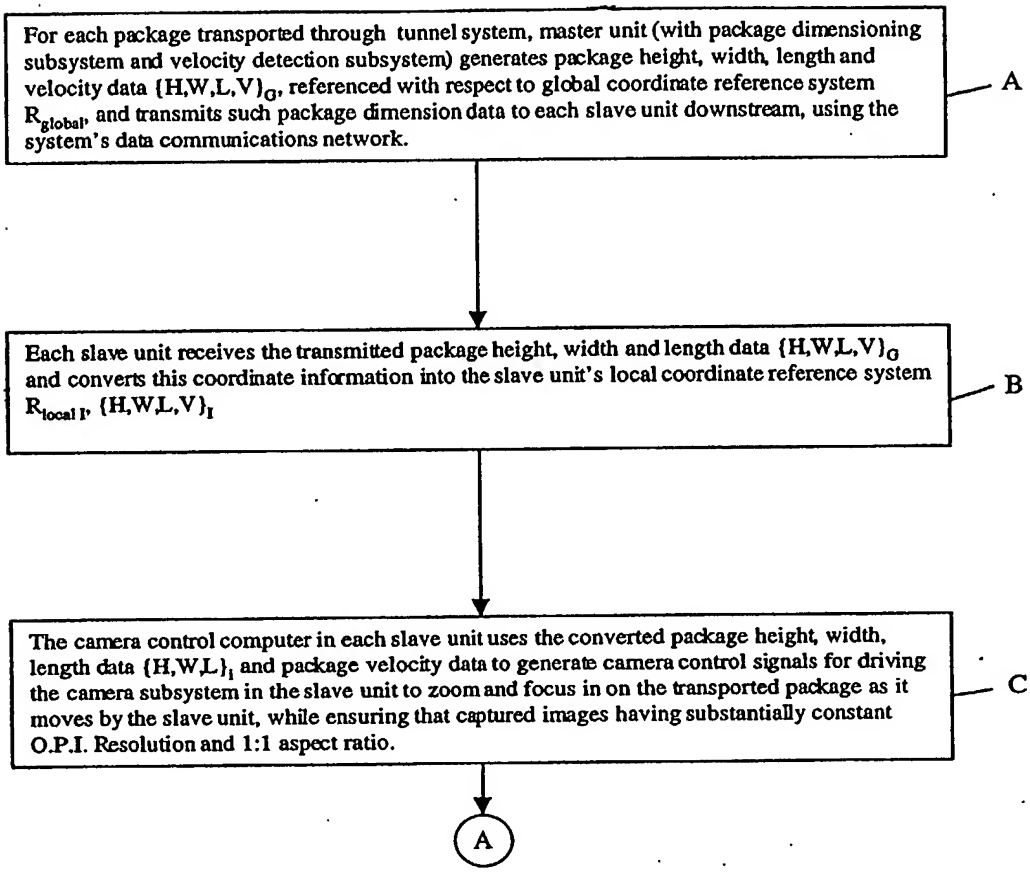

For each package transported through tunnel system, master unit (with package dimensioning subsystem and velocity detection subsystem) generates package height, width, length and velocity data $\{H,W,L,V\}_G$, referenced with respect to global coordinate reference system R_{global}, and transmits such package dimension data to each slave unit downstream, using the system's data communications network.
A
Each slave unit receives the transmitted package height, width and length data $\{H,W,L,V\}_G$ and converts this coordinate information into the slave unit's local coordinate reference system $R_{local\ I}$, $\{H,W,L,V\}_I$
B
The camera control computer in each slave unit uses the converted package height, width, length data $\{H,W,L\}_I$ and package velocity data to generate camera control signals for driving the camera subsystem in the slave unit to zoom and focus in on the transported package as it moves by the slave unit, while ensuring that captured images having substantially constant O.P.I. Resolution and 1:1 aspect ratio.
C
A

FIG. 32A

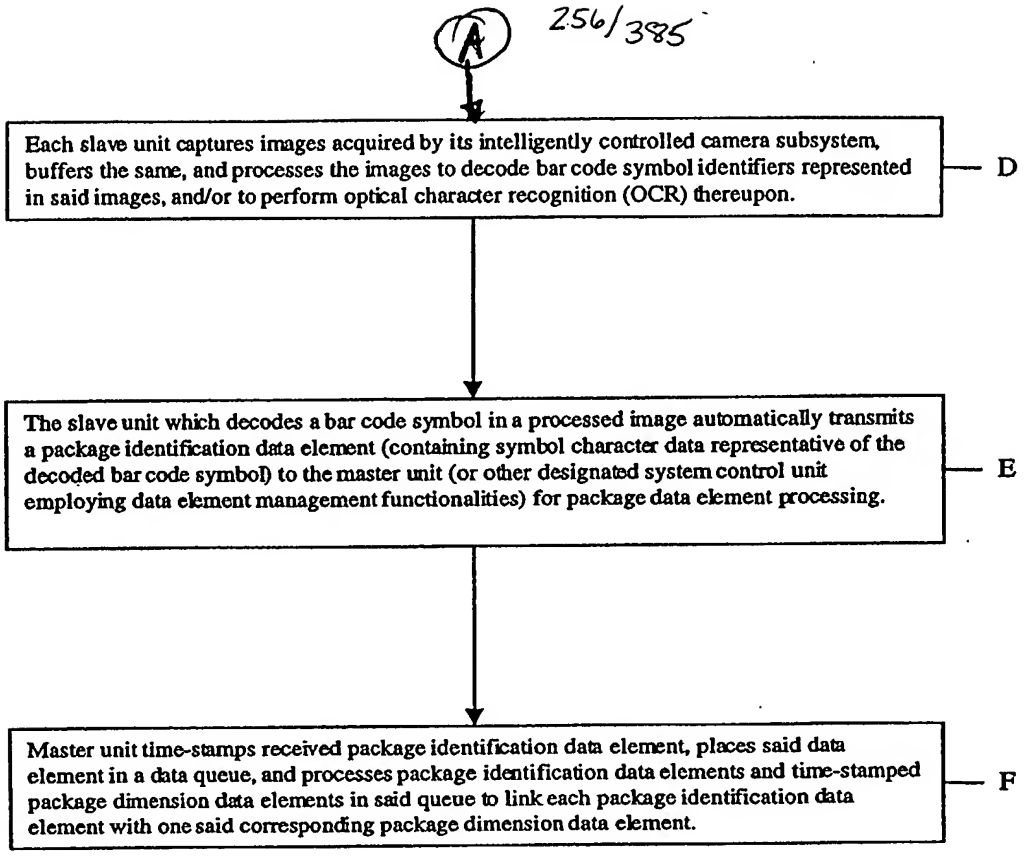


FIG. 32B

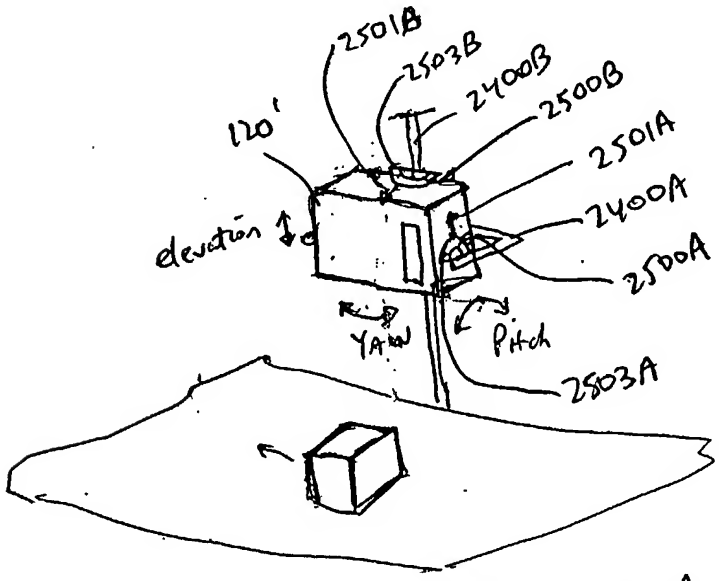


FIG. 31A

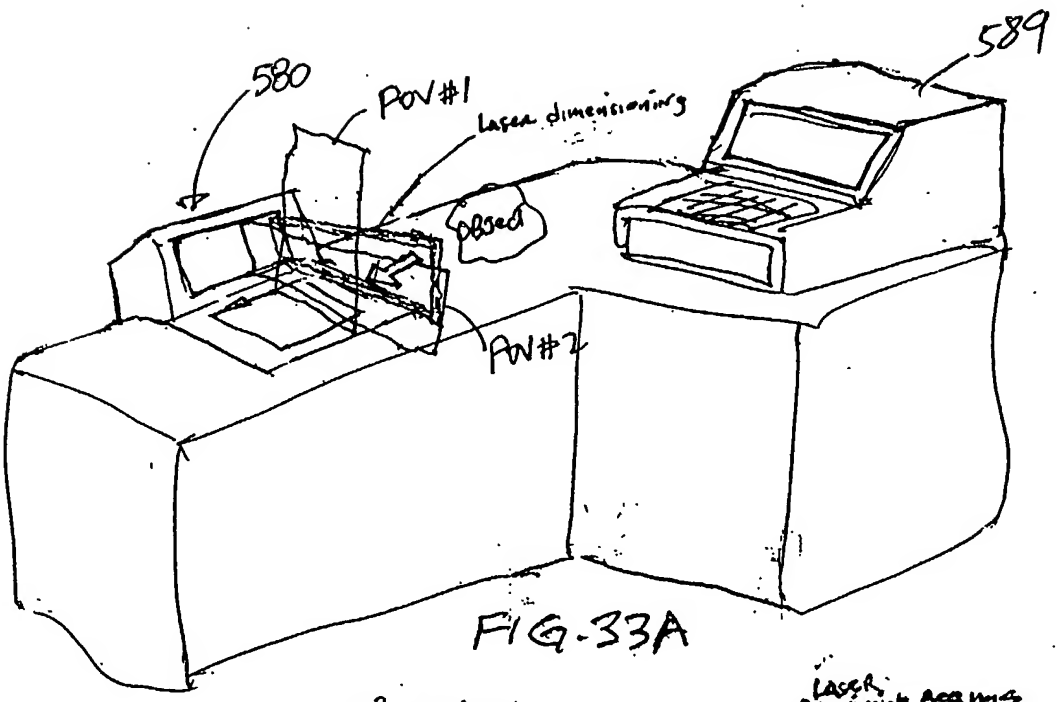


FIG-33A

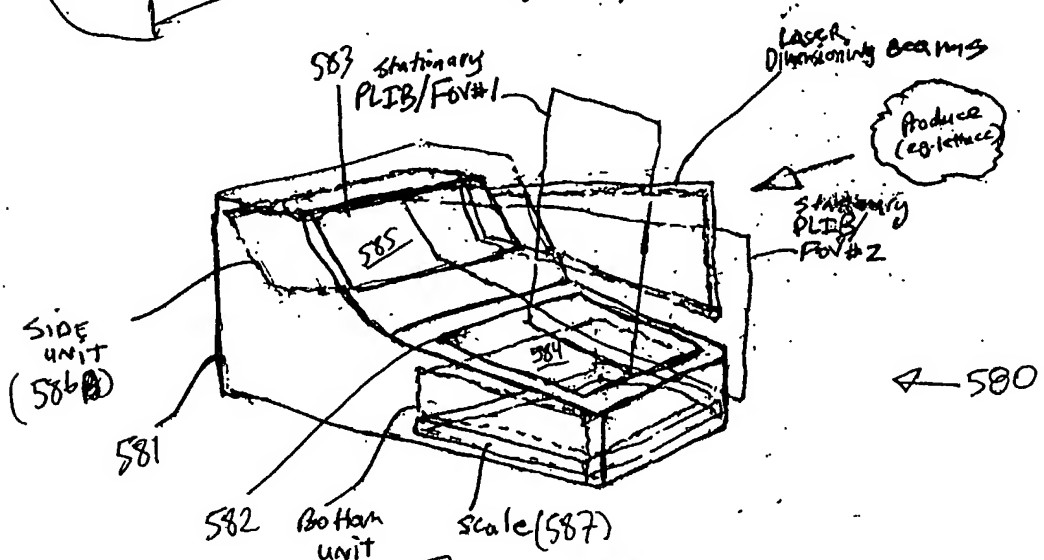


FIG. 33B

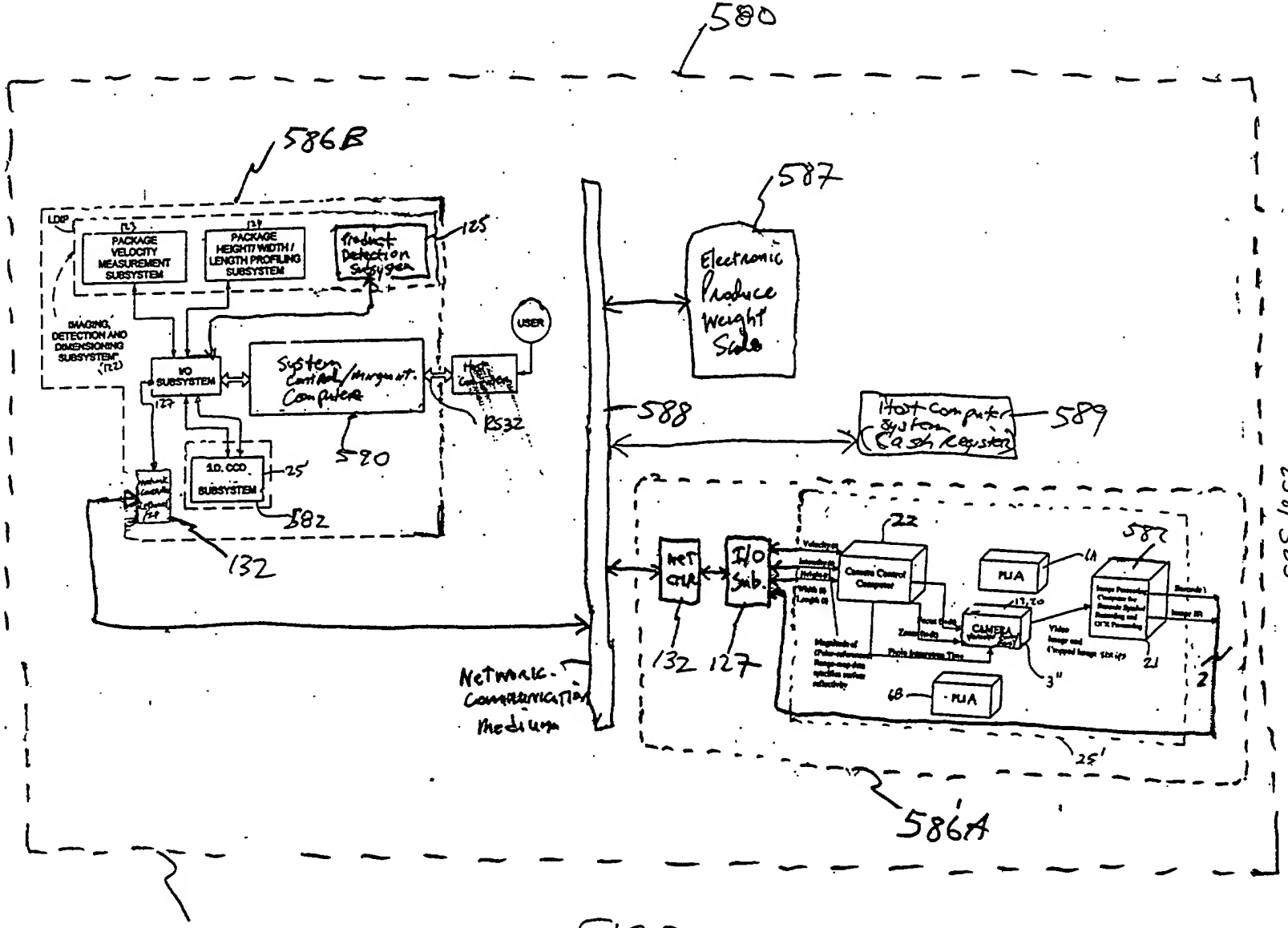

580
586B
587
PACKAGE VELOCITY MEASUREMENT SUBSYSTEM
PACKAGE HEIGHT/ WIDTH / LENGTH PROFILING SUBSYSTEM
Product Detection Subsystem
125
IMAGING, DETECTION AND DIMENSIONING SUBSYSTEM
(122)
I/O SUBSYSTEM
System Control/Management Computer
USER
RS232
580
1D. CCD SUBSYSTEM
25'
582
132
Electronic Produce Weight Scale
588
Host computer system (Cash Register)
589
NET CTLR
I/O Sub.
132
127
Network Communication Medium
22
Camera Control Computer
PLIA
11
587
CAMERA
3"
21
2
68
PLIA
25'
586A
258/385'

FIG. 33C

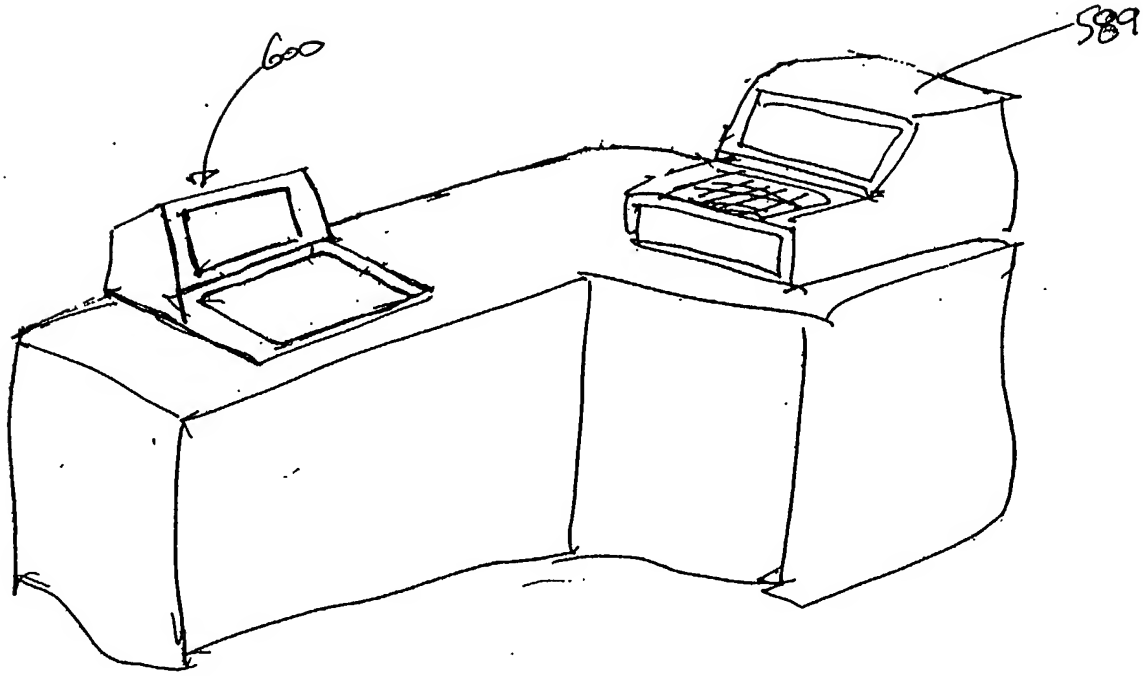


FIG. 34A

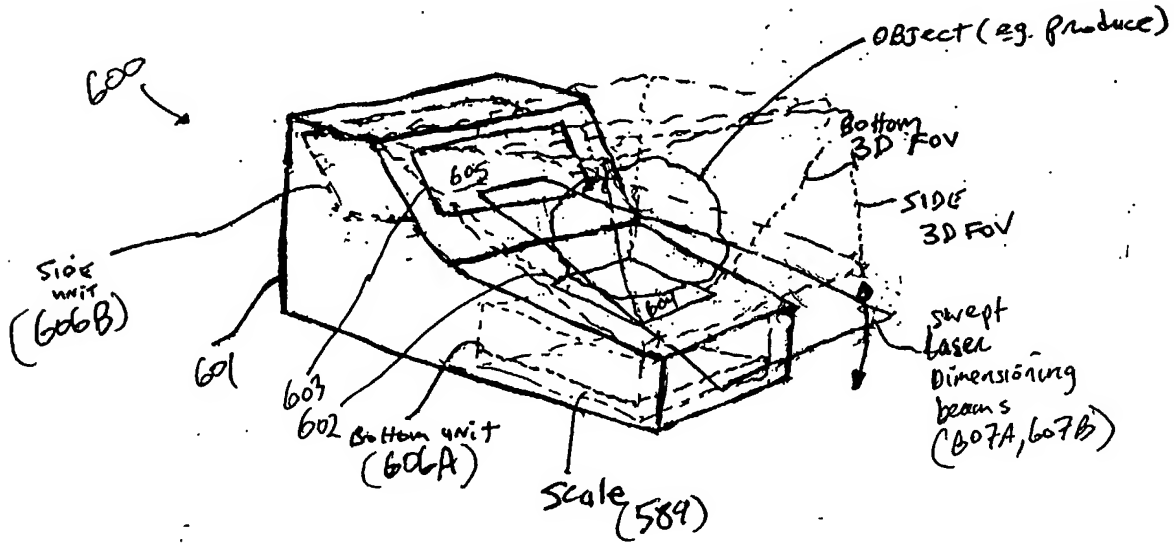


FIG. 34B

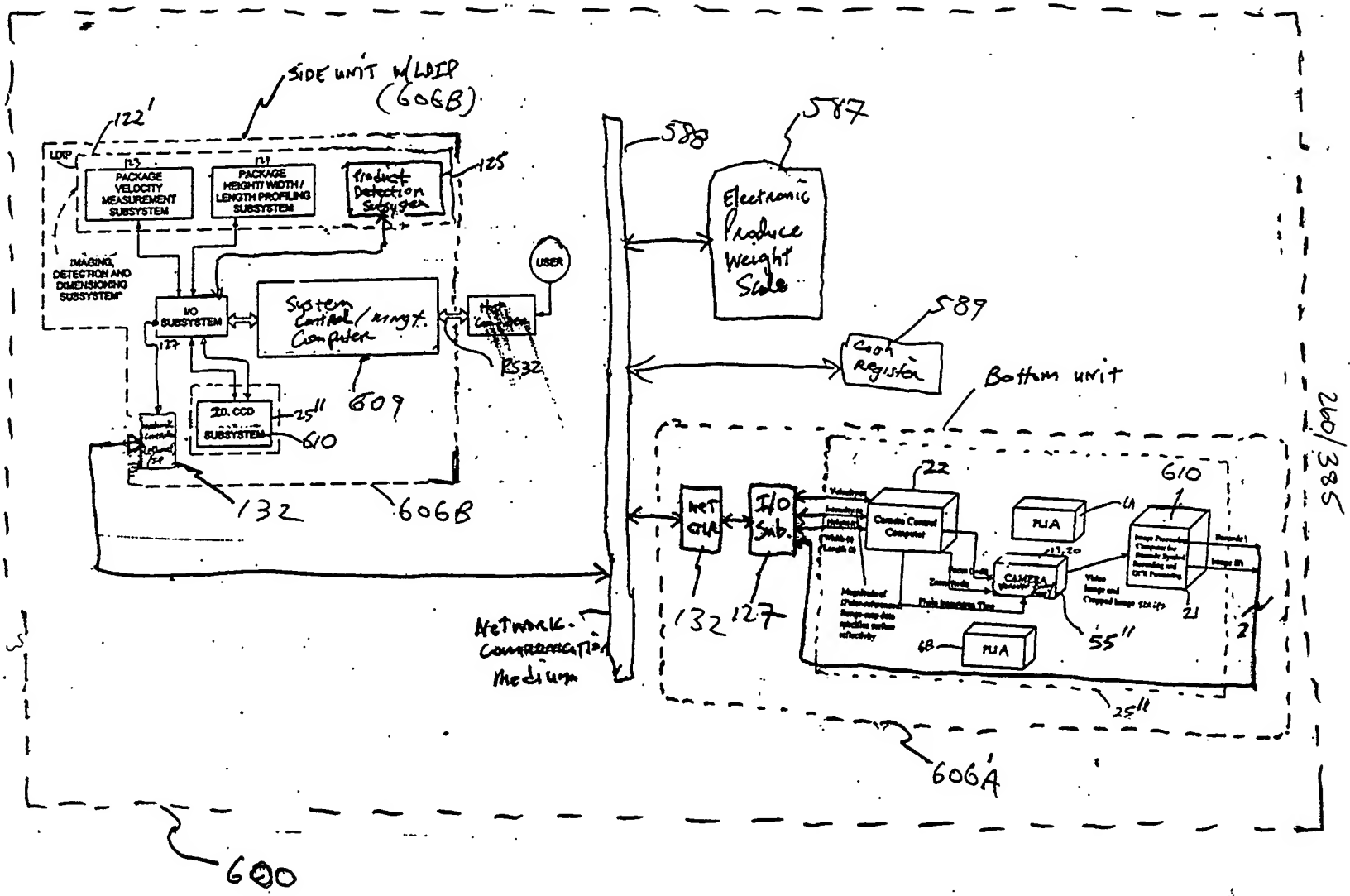

SIDE UNIT W/LDIP (606B)
122'
LDIP
PACKAGE VELOCITY MEASUREMENT SUBSYSTEM
PACKAGE HEIGHT/ WIDTH / LENGTH PROFILING SUBSYSTEM
Product Detection Subsystem
125
IMAGING, DETECTION AND DIMENSIONING SUBSYSTEM
I/O SUBSYSTEM
System Control / mngt. Computer
609
USER
RS232
2D. CCD SUBSYSTEM
25''
610
132
606B
588
587
Electronic Produce Weight Scale
589
Cash Register
Bottom unit
260/385
NET CTLR
I/O Sub.
Cosmic Control Computer
22
610
LA
PUA
CAMERA
19,20
55''
21
2
68
PUA
132
127
Network Communication Medium
25''
606A
600

FIG 34C

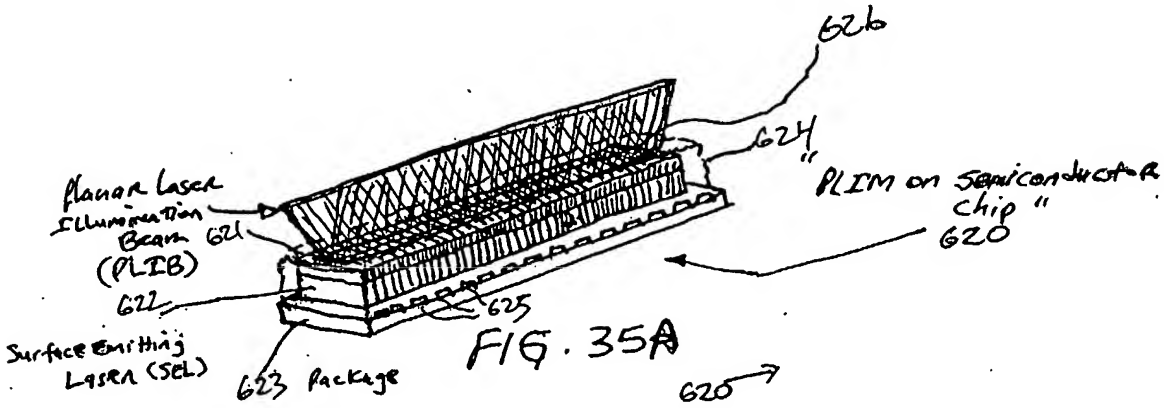


FIG. 35A

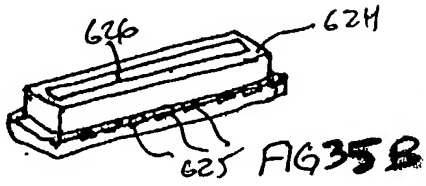


FIG 35B

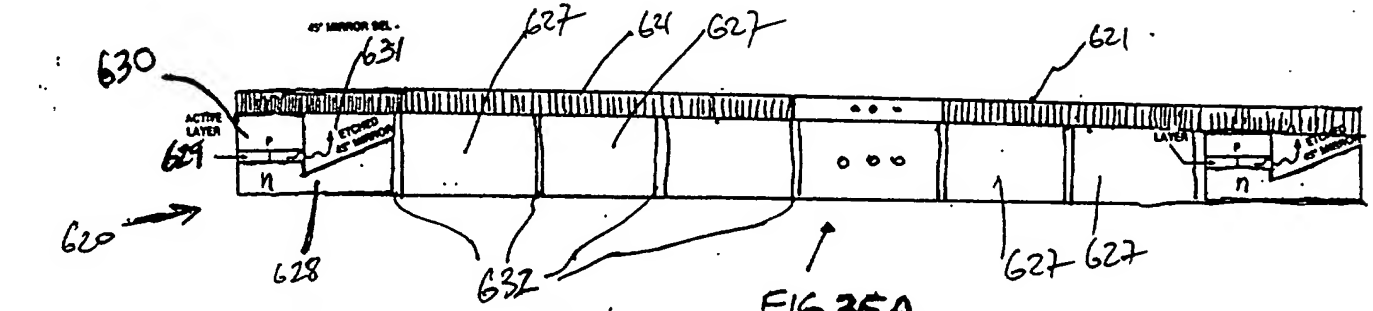


FIG 35A

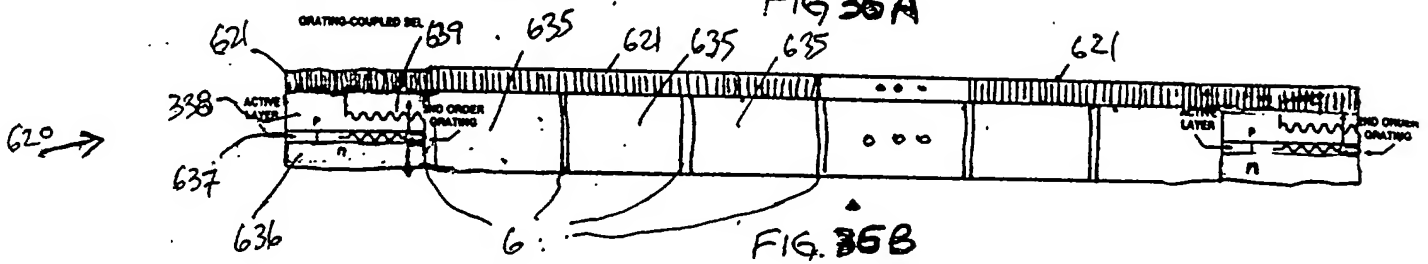


FIG. 35B

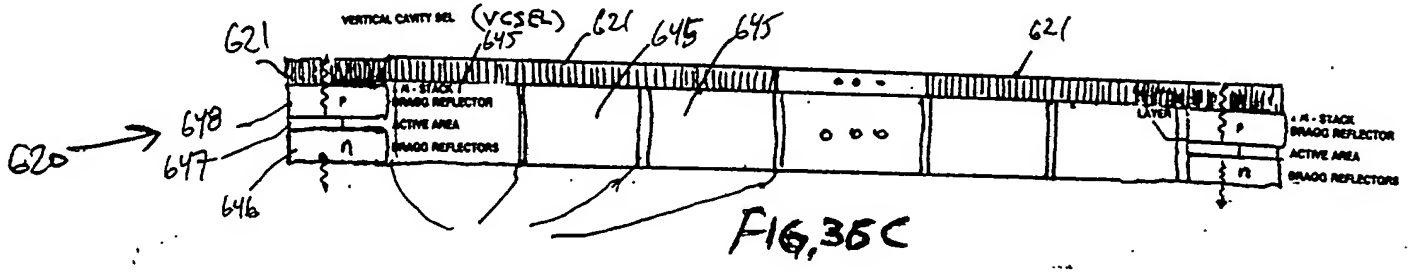


FIG. 35C

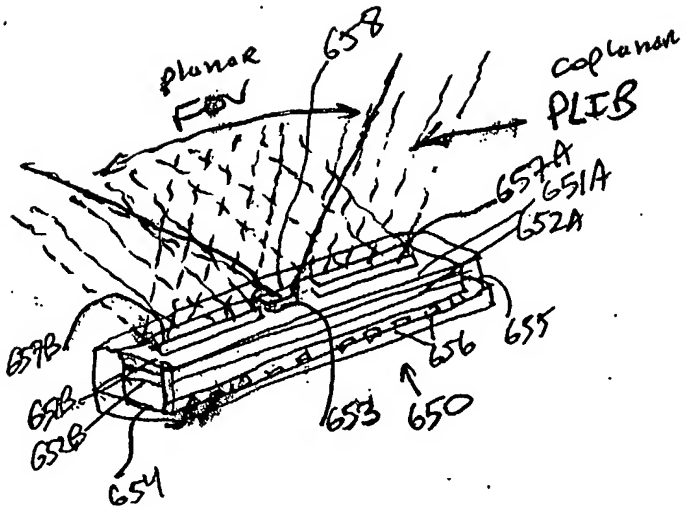

planar
FOV
658
coplanar
PLIB
657A
651A
652A
655
656
650
653
654
657B
652B
652B

FIG. 37

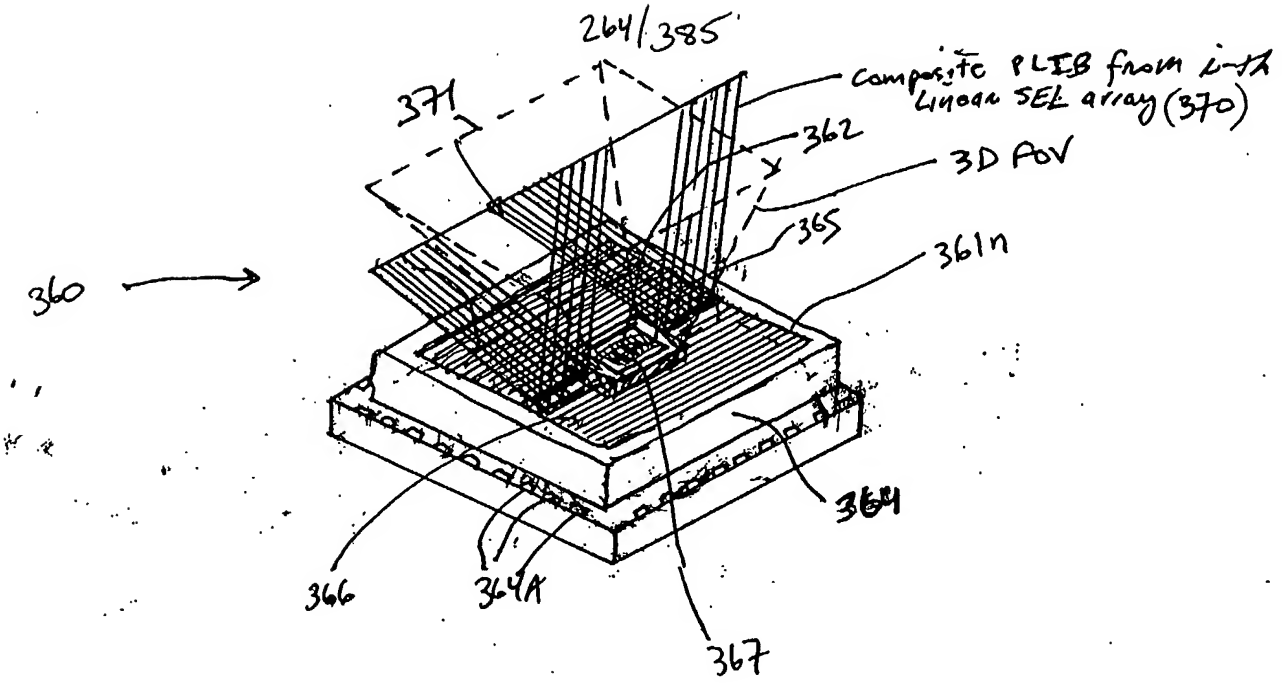


FIG. 38A

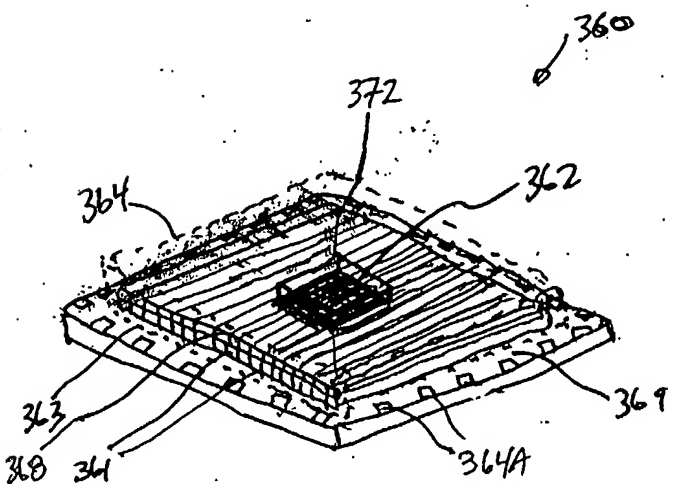


FIG. 38B

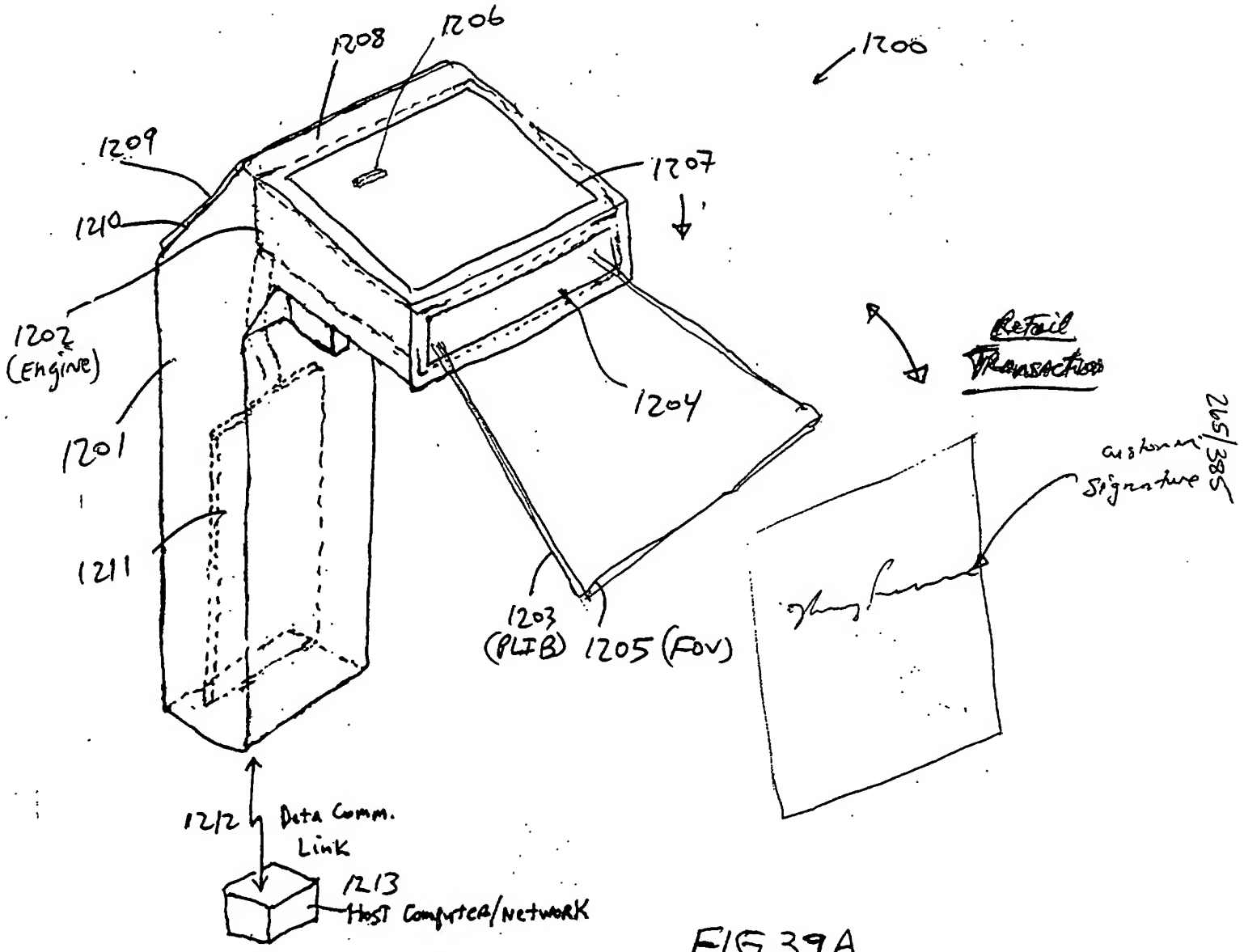

1200
1208
1206
1209
1207
1210
1202
(Engine)
1204
1201
1211
1203
(PLIB)
1205 (FOV)
Retail
Transaction
customer
Signature
265/385
1212
Data Comm.
Link
1213
Host Computer/Network

FIG.39A

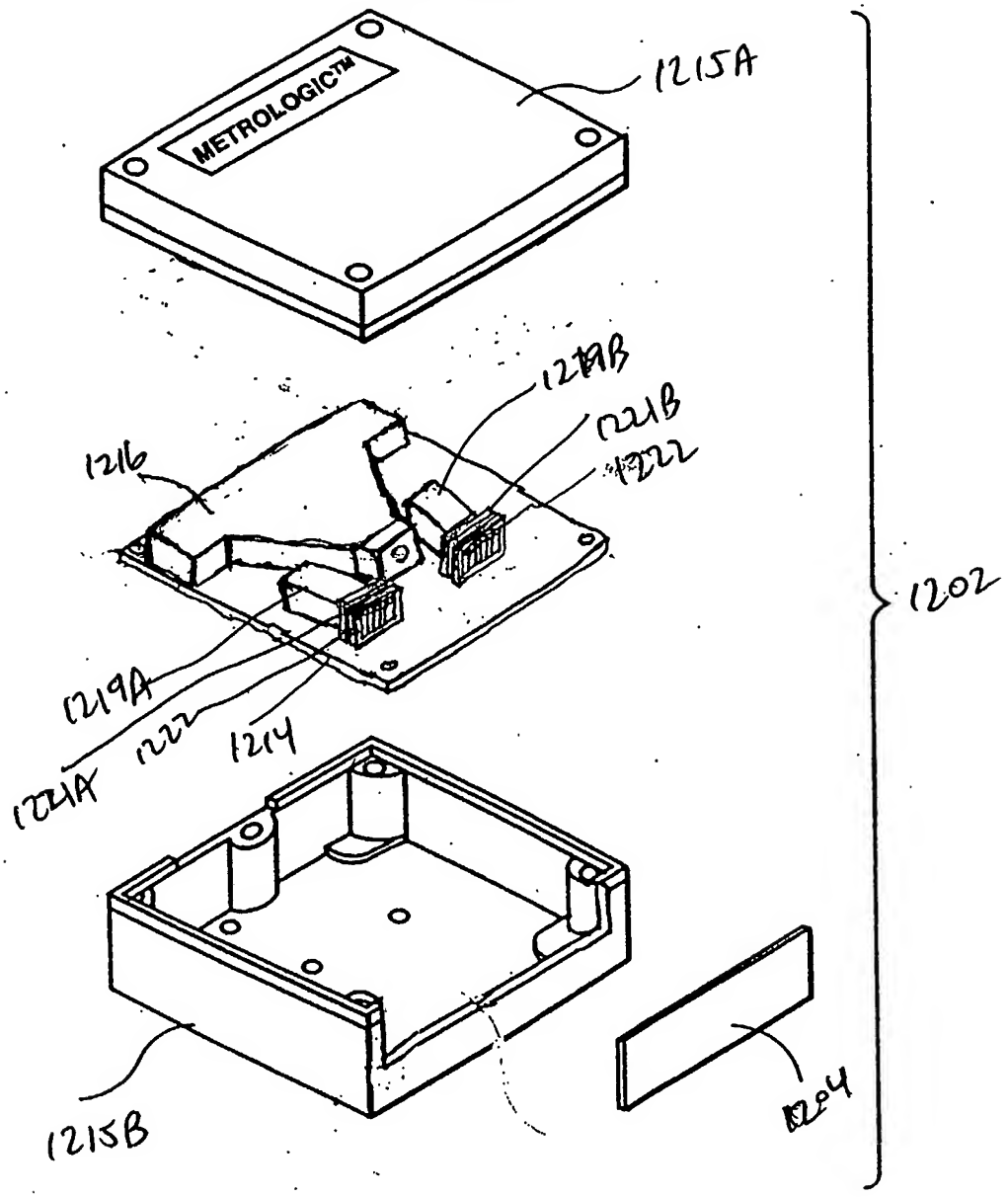

METROLOGIC™
1215A
1219B
1221B
1222
1216
1202
1219A
1221A
1222
1214
1215B
1204

FIG. 39B

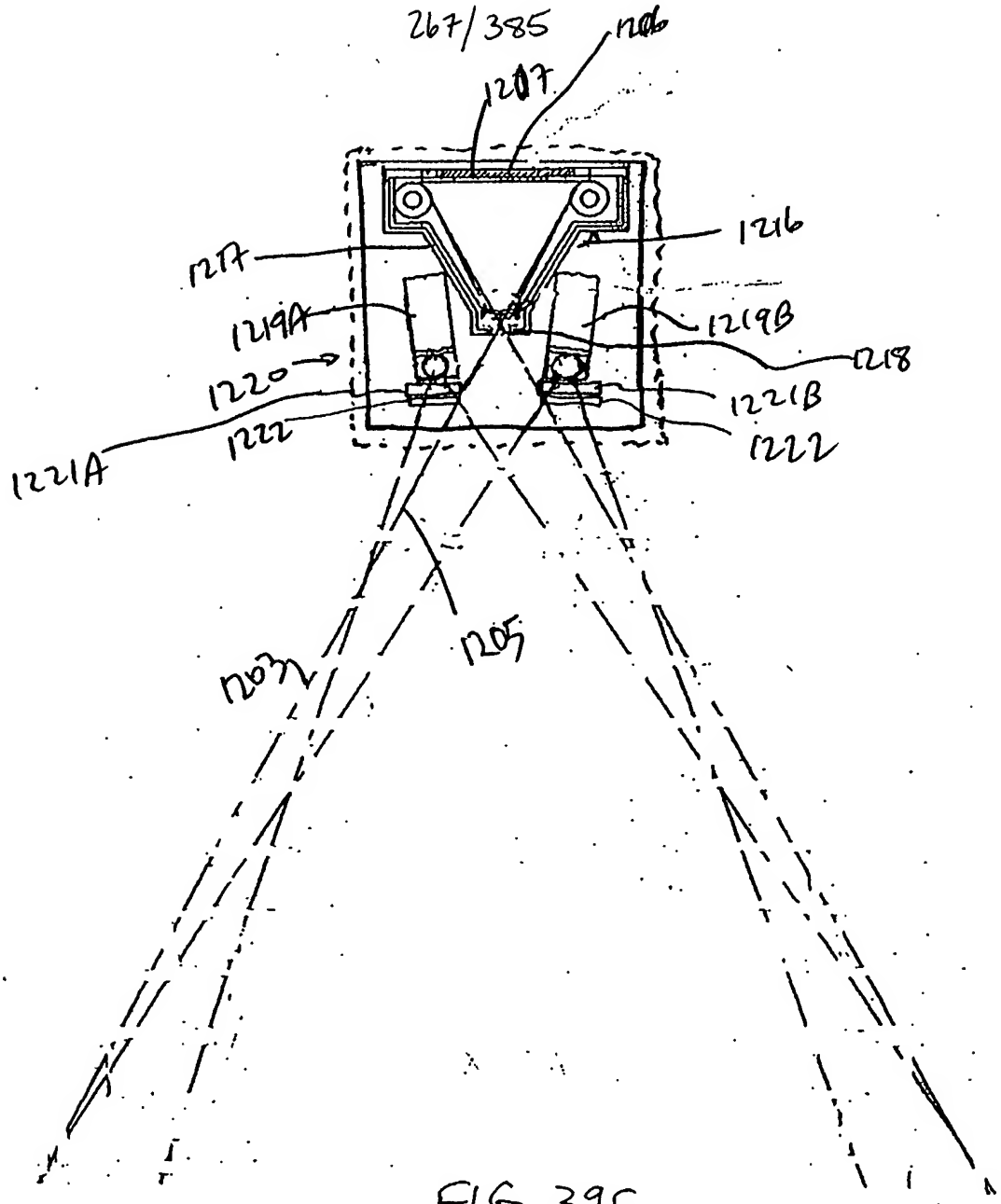

267/385
1206
1207
1216
1217
1219A
1219B
1218
1220
1221B
1221A
1222
1222
1203
1205

FIG. 39C

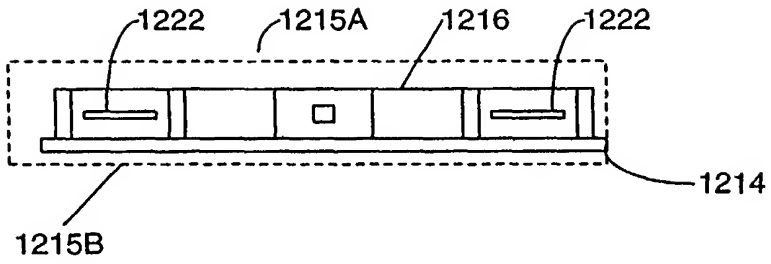


FIG. 39D

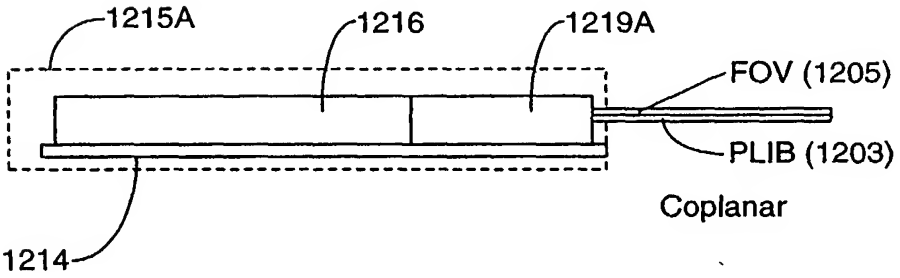


FIG. 39E

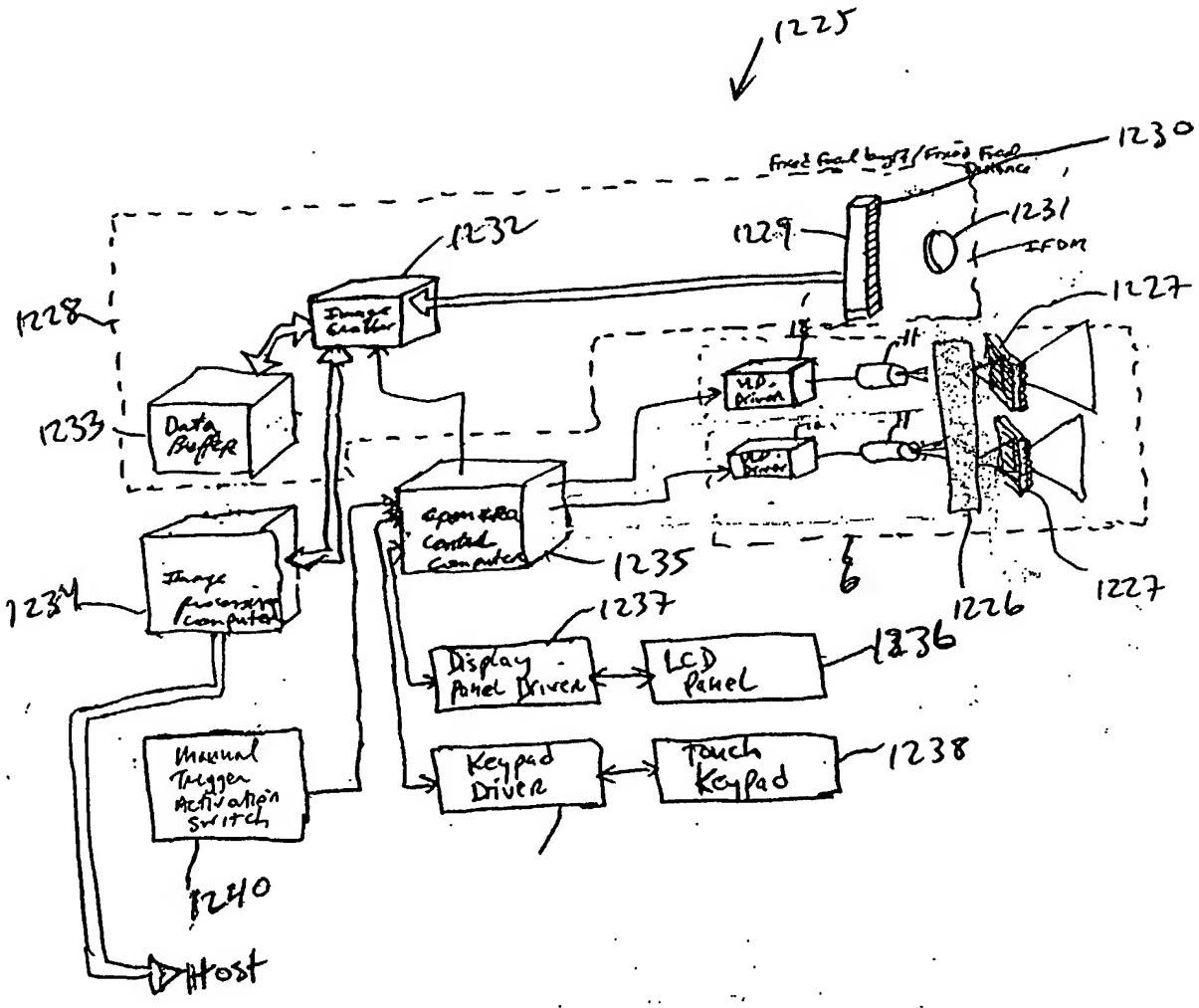

1225
1230
1231
IFOM
1229
1232
1228
1227
1233
Data Buffer
1234
Image Processing Computer
1235
1237
Display Panel Driver
LCD Panel
1236
Manual Trigger Activation Switch
Keypad Driver
Touch Keypad
1238
1240
Host
1226

FIG. 40A1

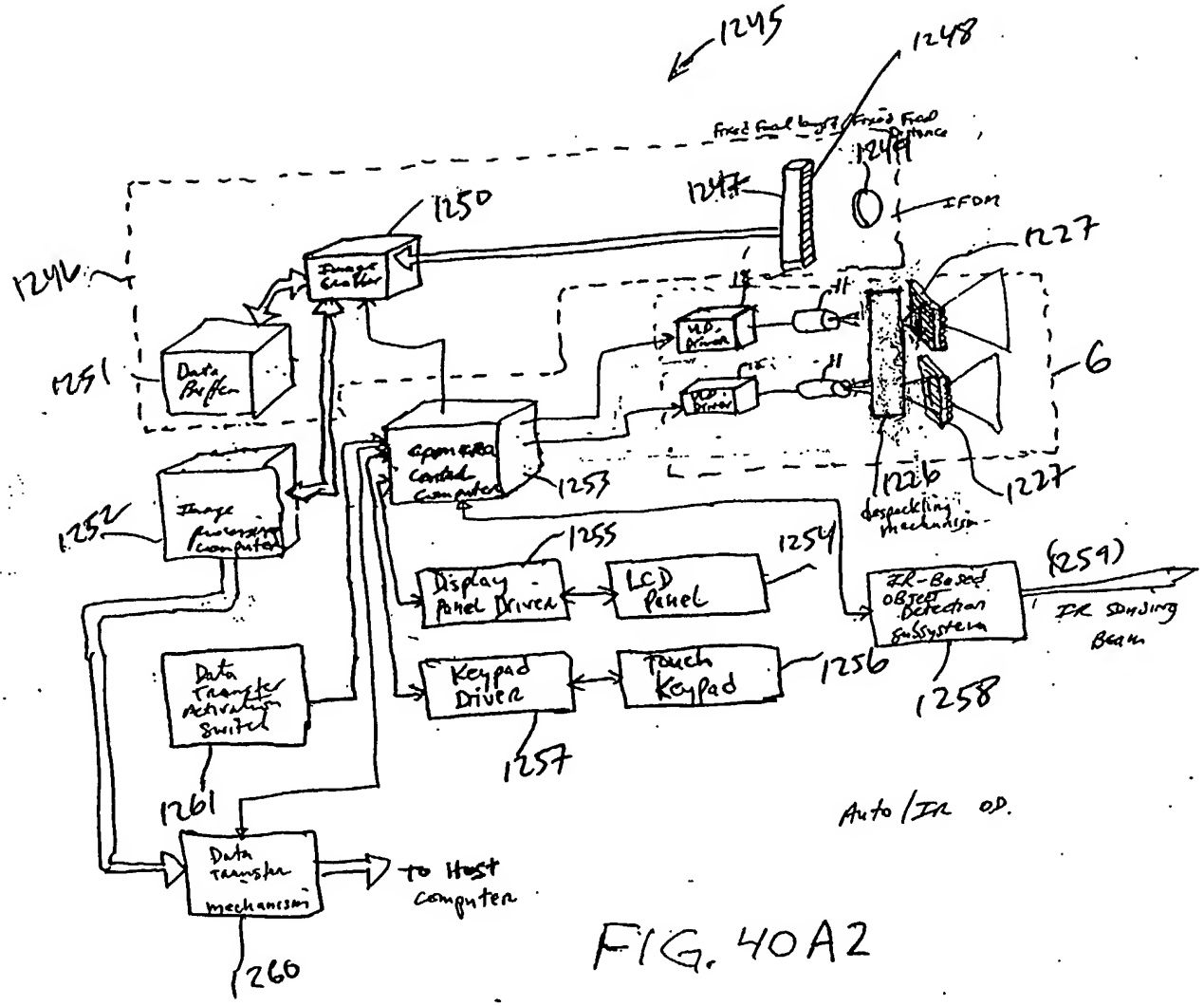

1245
1248
1249
1247
IFOM
1250
1246
1227
Image Capture
Data Buffer
1251
LD. Driver
LED Driver
6
Camera Control Computer
1253
1226
1227
Image Processing Computer
1252
Despeckling Mechanism
1255
1254
Display Panel Driver
LCD Panel
IR-Based Object Detection Subsystem
1259
IR Sensing Beam
Data Transfer Activation Switch
Keypad Driver
Touch Keypad
1256
1258
1257
1261
Auto/IR OD.
Data transfer mechanism
to Host computer
1260

FIG. 40A2

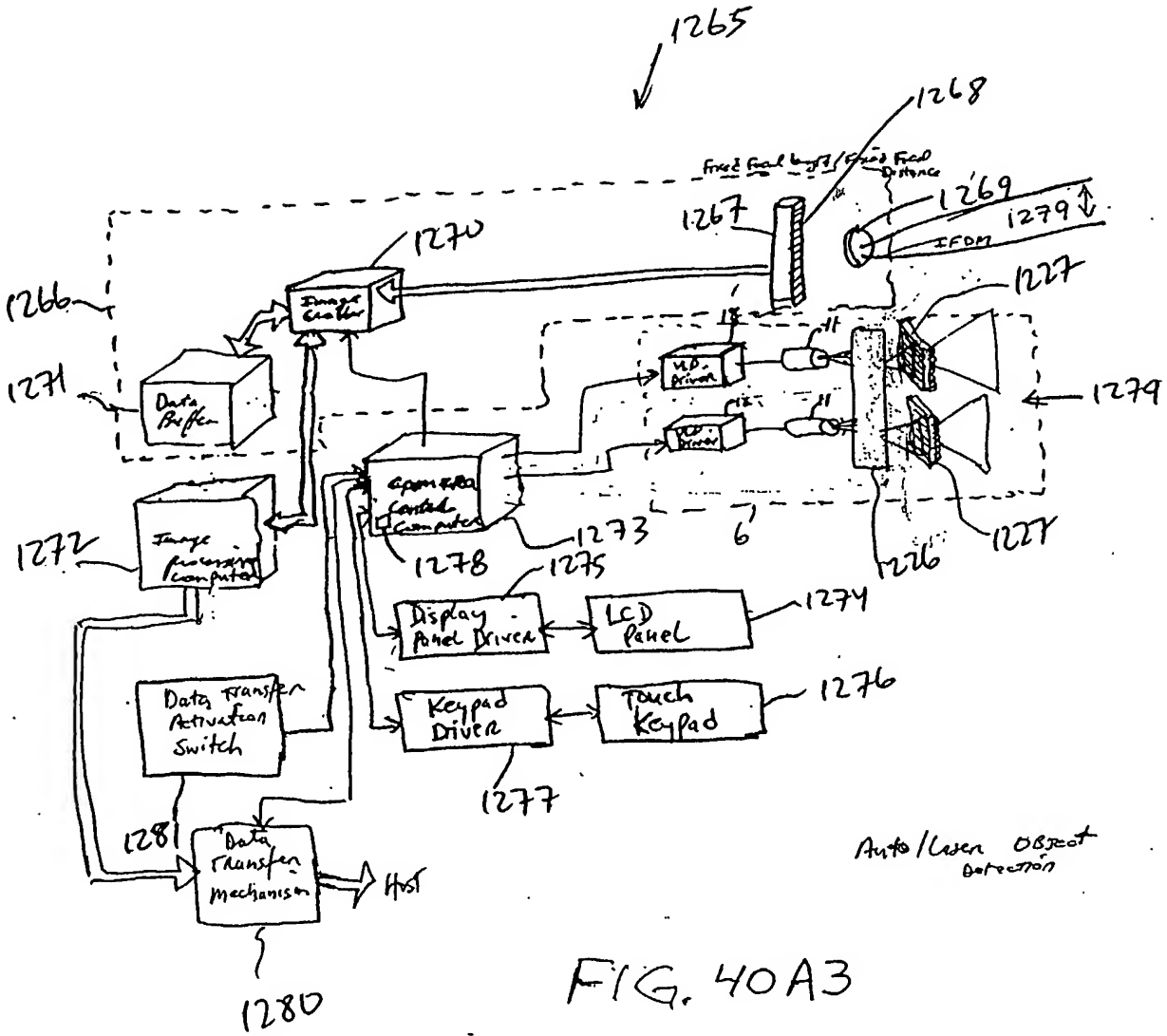

1265
1268
1269
1279
1267
1270
1266
1271
1227
1279
1272
1273
1278
1275
1274
1226
Display Panel Driver
LCD Panel
Data Transfer Activation Switch
Keypad Driver
Touch Keypad
1276
1277
1281
Data Transfer Mechanism
Host
1280
Auto/Laser Object Detection

FIG. 40A3

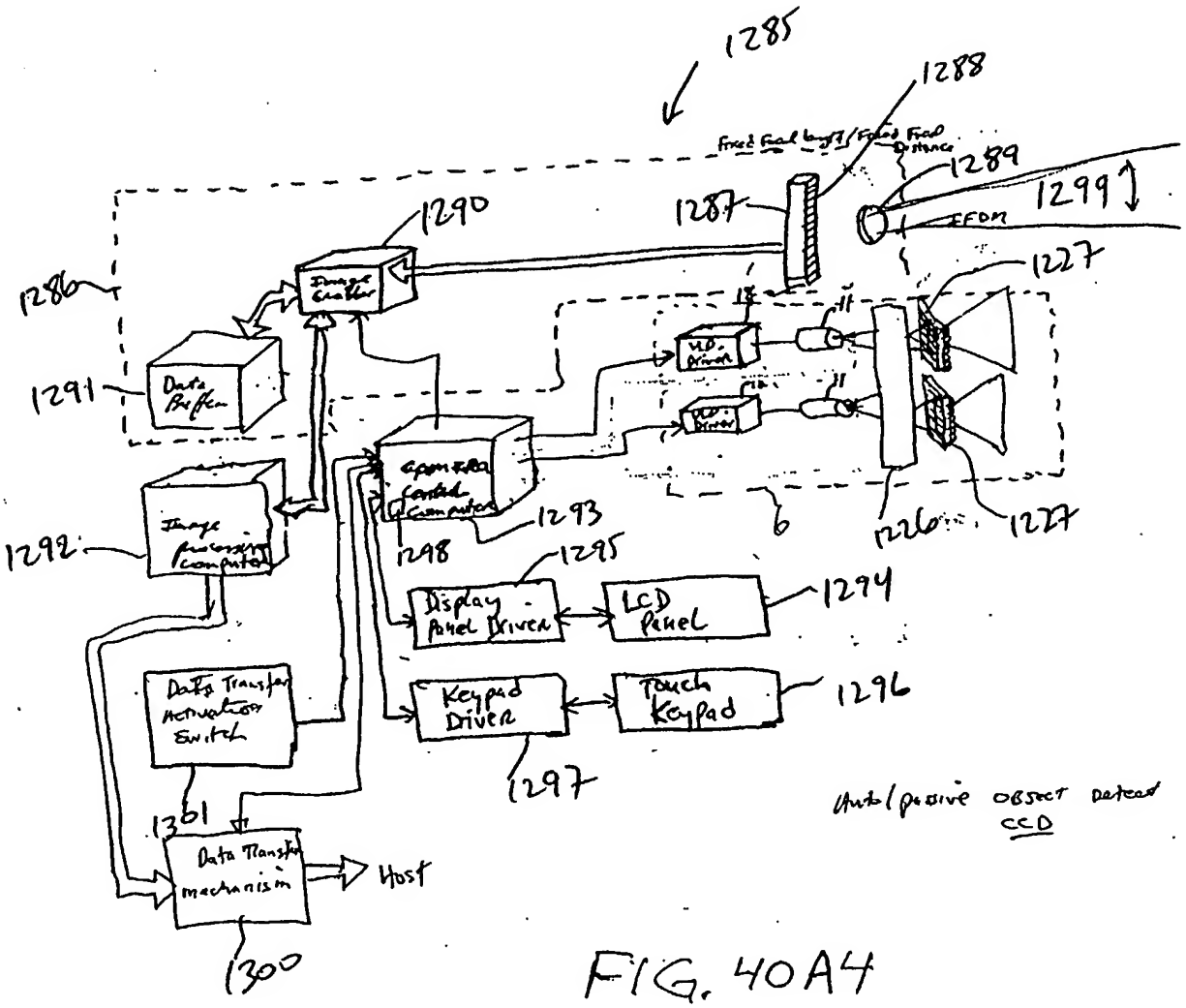

1285
1288
1289
1299
EFOM
1290
1287
1227
1280
1291
Data Buffer
1292
Image Processing Computer
1293
1298
1295
Display Panel Driver
LCD Panel
1294
Keypad Driver
Touch Keypad
1296
1297
Data Transfer Activation Switch
1361
Data Transfer mechanism
Host
1300
1226
Auto/passive object detect
CCD

FIG. 40A4

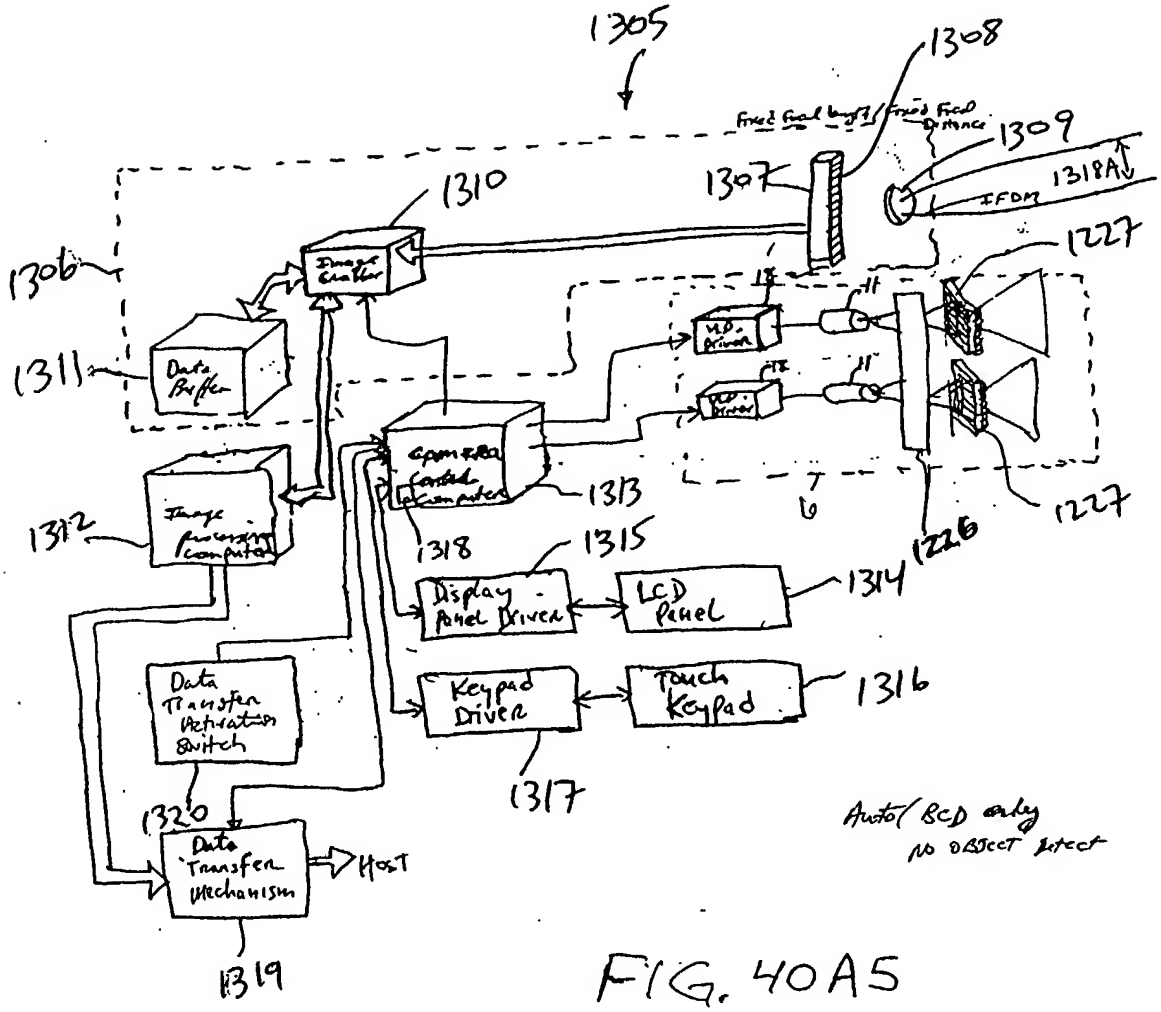

1305
1308
1309
1310
1307
1306
1311
1227
1312
1313
1318
1315
1314
1226
Display Panel Driver
LCD Panel
Keypad Driver
Touch Keypad
1316
1317
Data Transfer Activation Switch
1320
Data Transfer Mechanism
Host
1319
Auto/BCD only
No object detect

FIG. 40A5

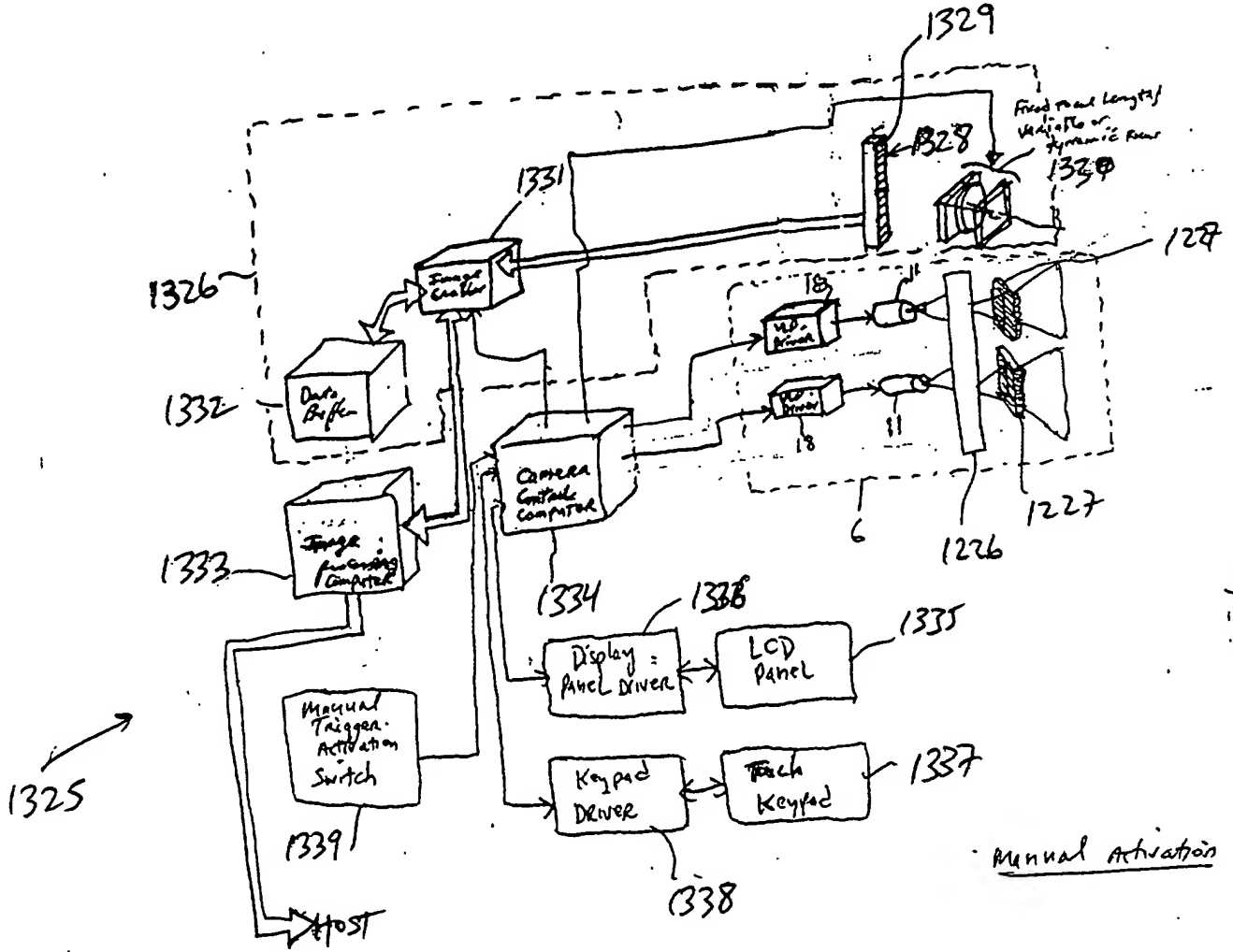

1329
1328
Fixed focal length/ variable or dynamic focus
1330
1331
1326
1327
1332
Data Buffer
Camera Control Computer
1333
Image Processing Computer
1334
1336
Display Panel Driver
LCD Panel
1335
Manual Trigger Activation Switch
1339
Keypad Driver
Touch Keypad
1337
1338
HOST
1325
Manual Activation

FIG. 40B1

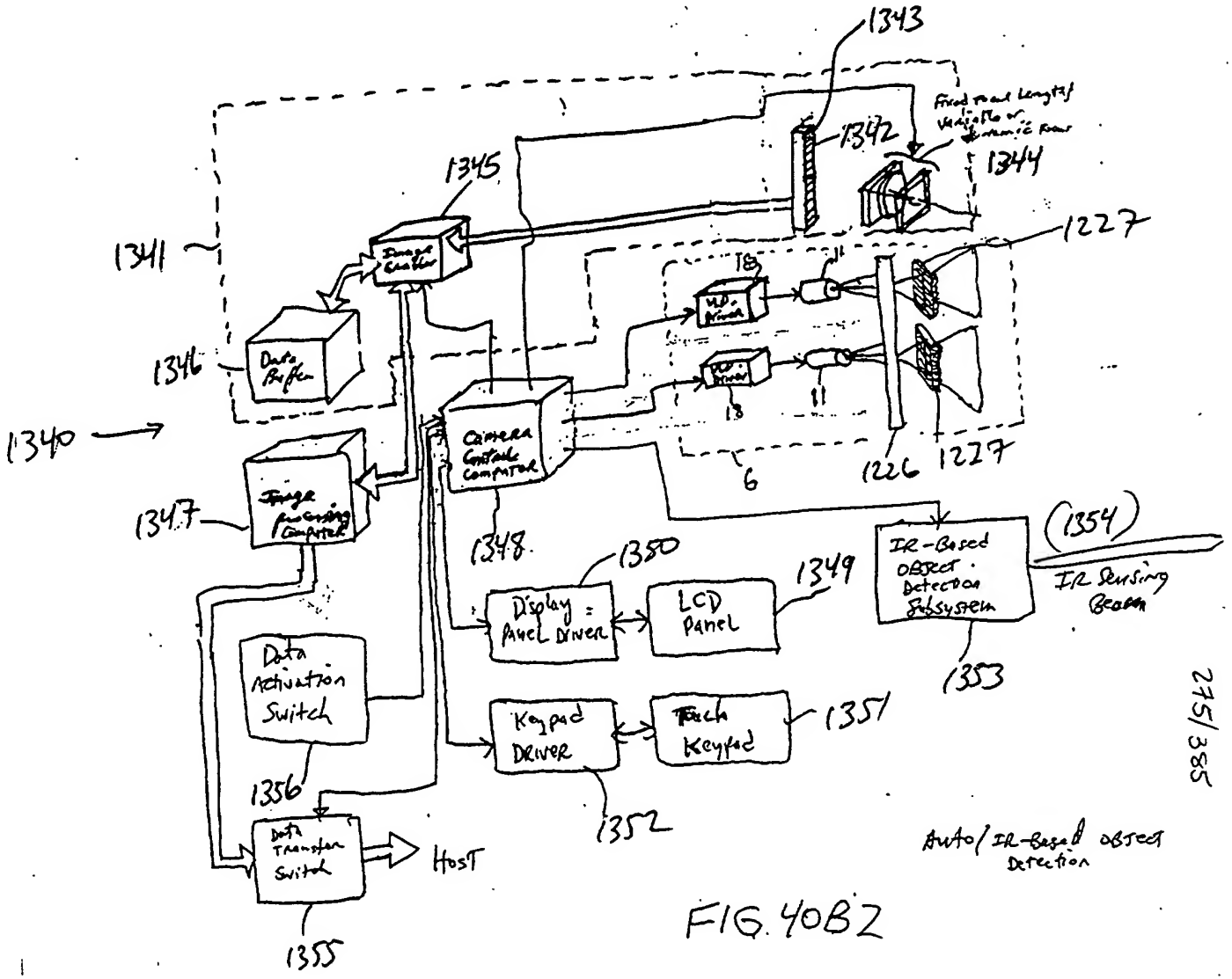

1343
1342
1344
1345
1341
1227
1346
1340
1347
1348
1350
1349
1354
IR-Based Object Detection Subsystem
IR Sensing Beam
1353
Data Activation Switch
Display Panel Driver
LCD Panel
Keypad Driver
Touch Keypad
1351
1356
1352
Data Transfer Switch
Host
1355
Auto/IR-Based Object Detection

FIG. 40B2

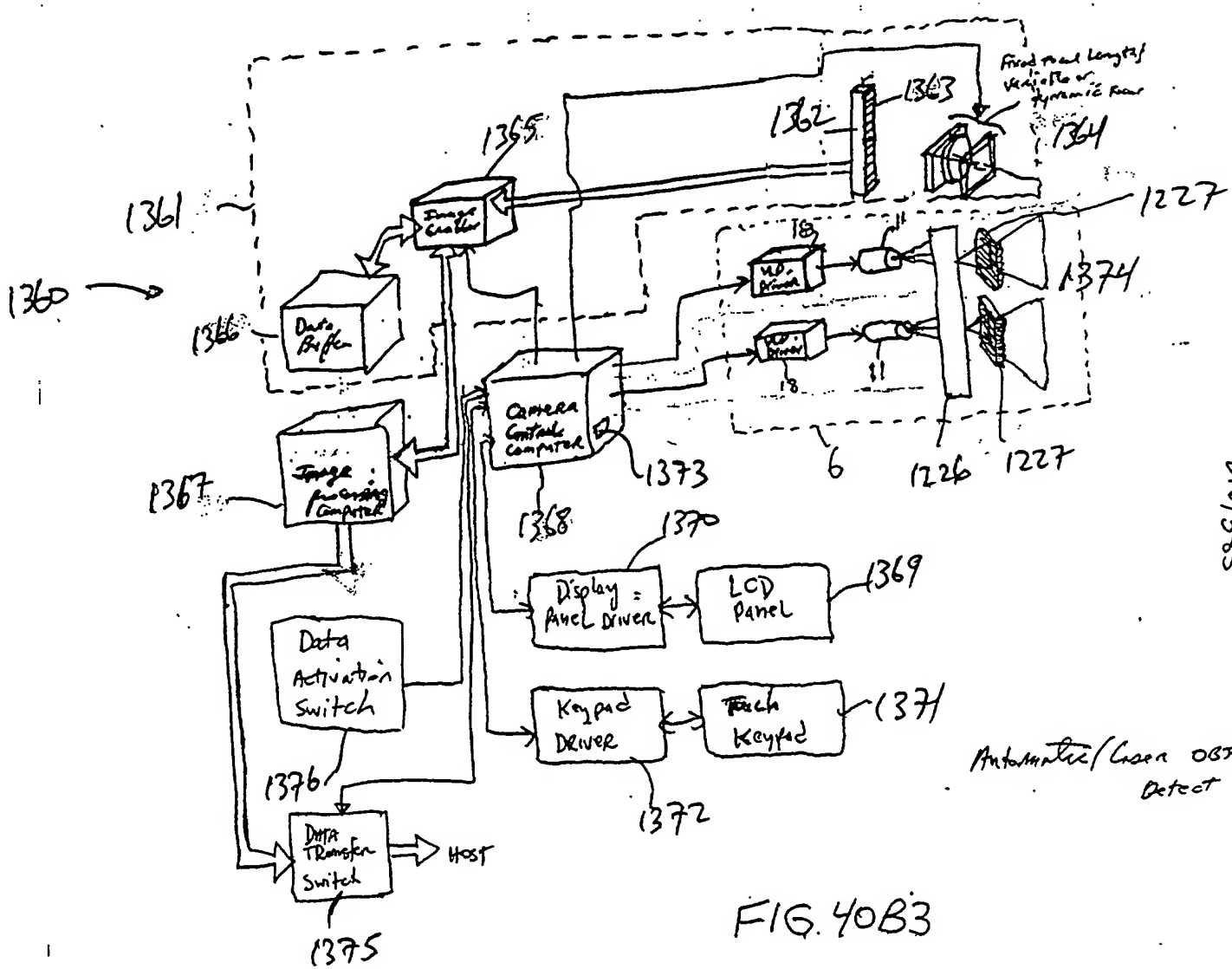

1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1227
1226
6
18
11
Data Buffer
Camera Control Computer
Image Processing Computer
Display Panel Driver
LCD Panel
Data Activation Switch
Keypad Driver
Touch Keypad
Data Transfer Switch
HOST
Automatic/Coarse Object Detect

FIG. 40B3

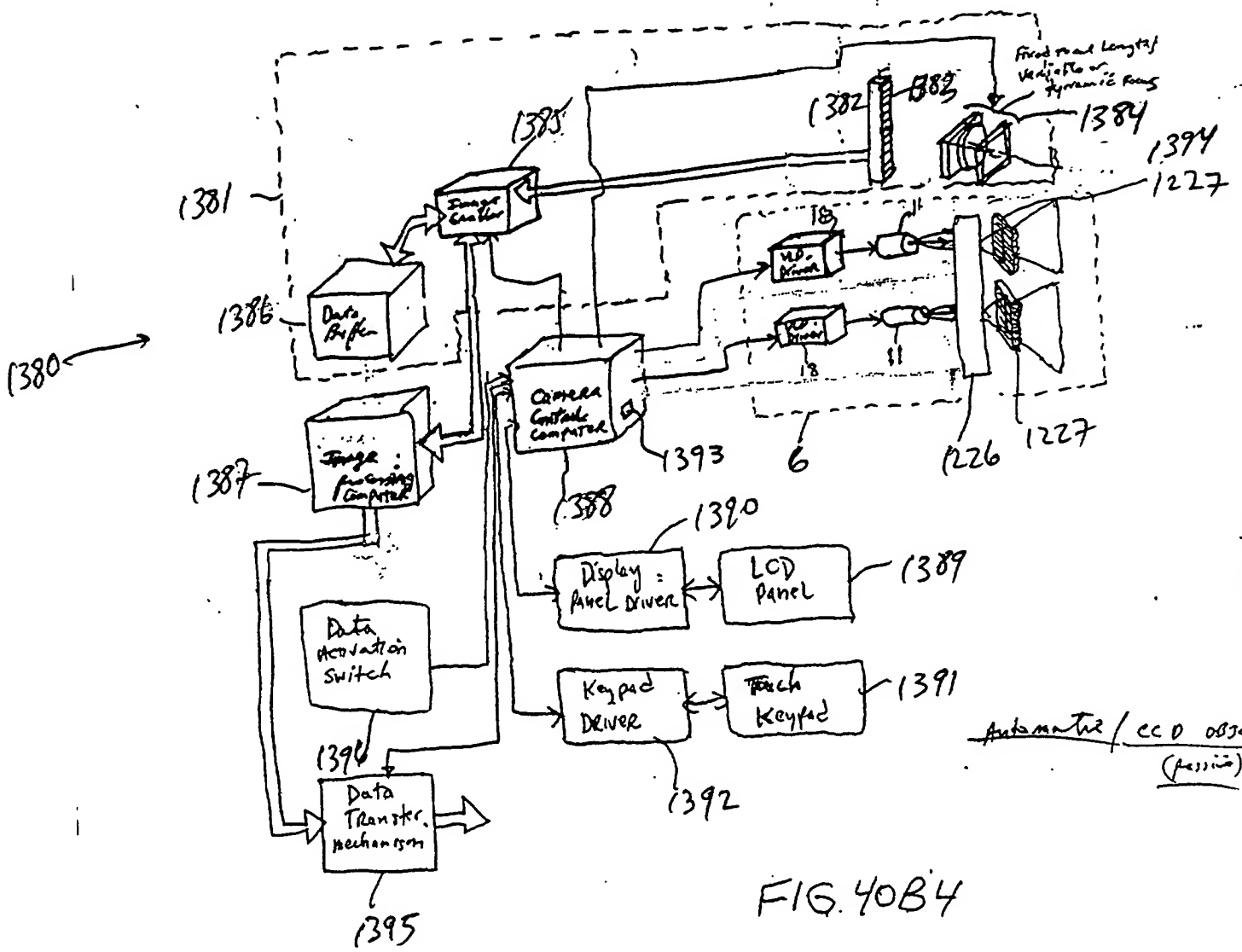


FIG. 40B4

20220207.2284.8001

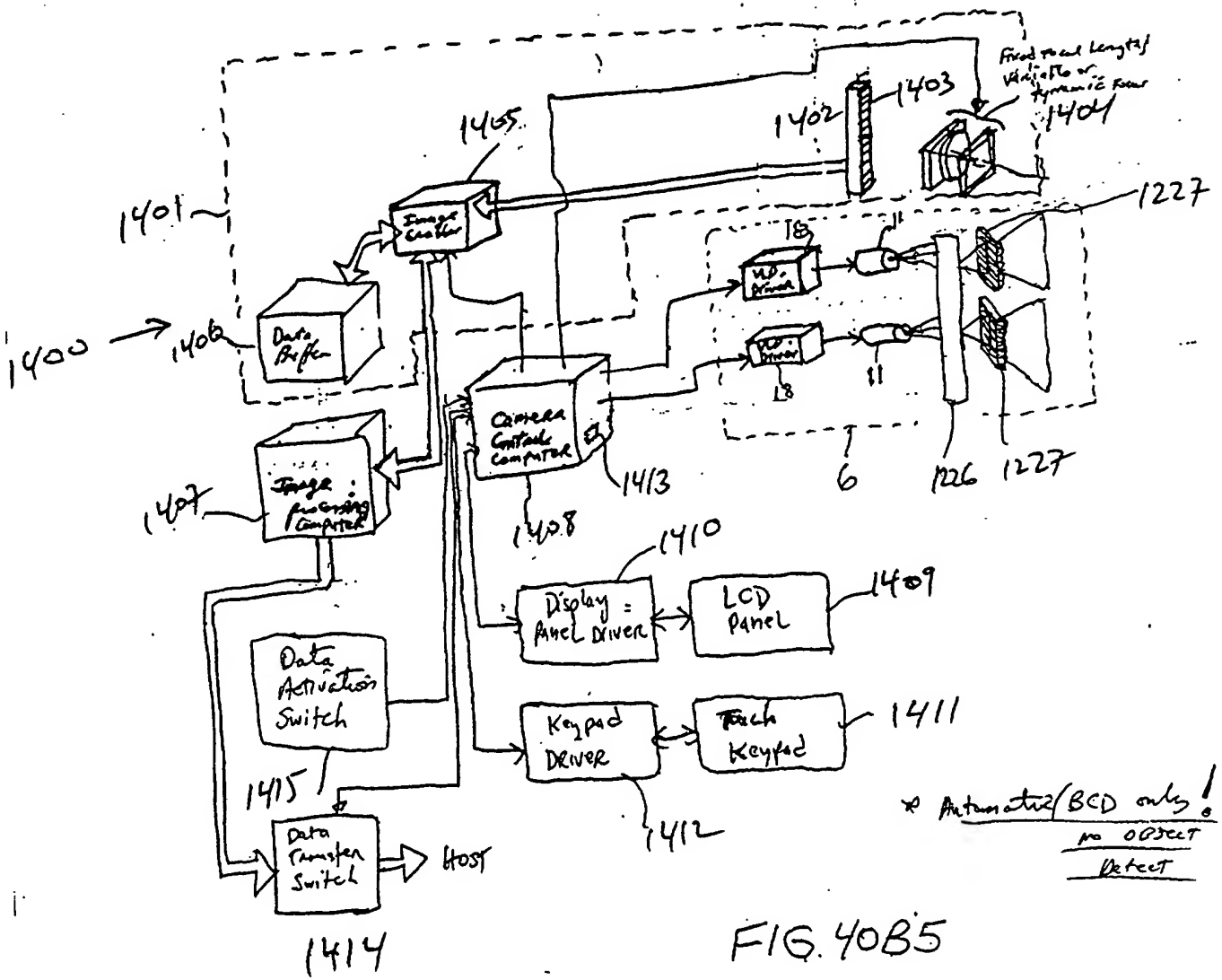


FIG. 40B5

EXHIBIT 2020 - 2020-00007

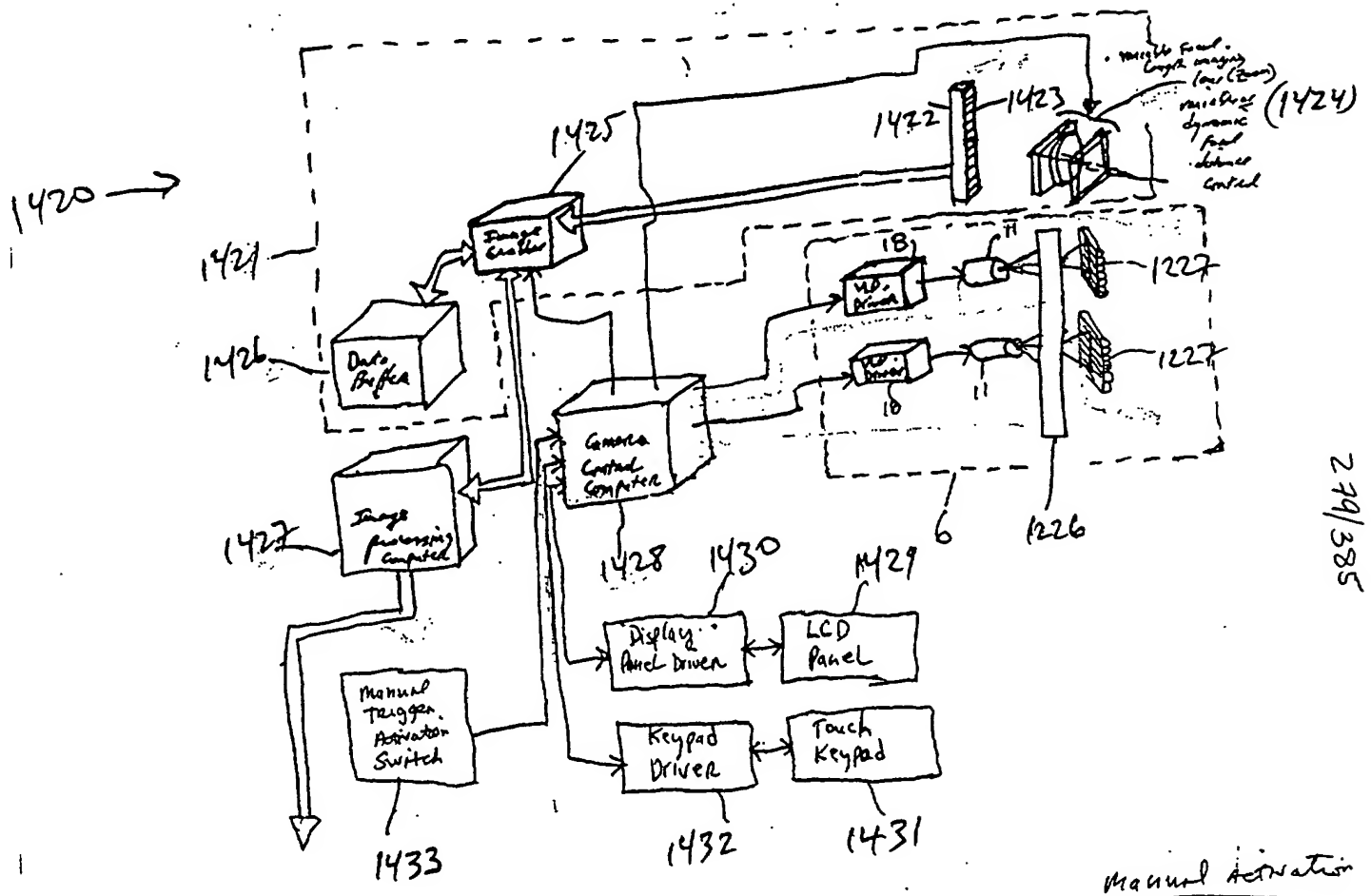

1420
1425
1424
1423
1422
1427
1426
1428
1430
1429
1433
1432
1431
1227
1226
Data Buffer
Camera Control Computer
Image Processing Computer
Display Panel Driver
LCD Panel
Manual Trigger Activator Switch
Keypad Driver
Touch Keypad
manual activation

FIG. 40C1

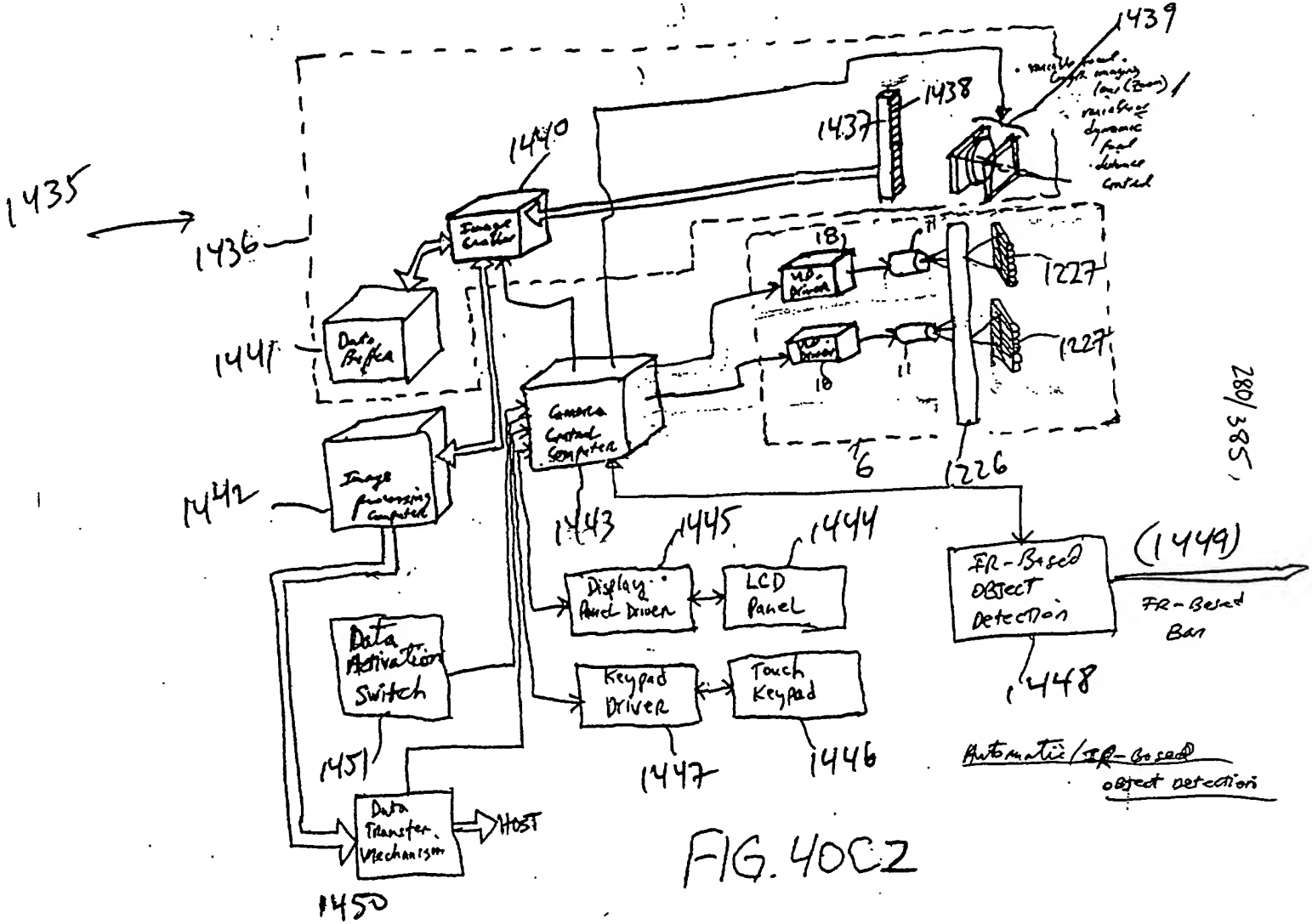


FIG. 40C2

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US006848629B2

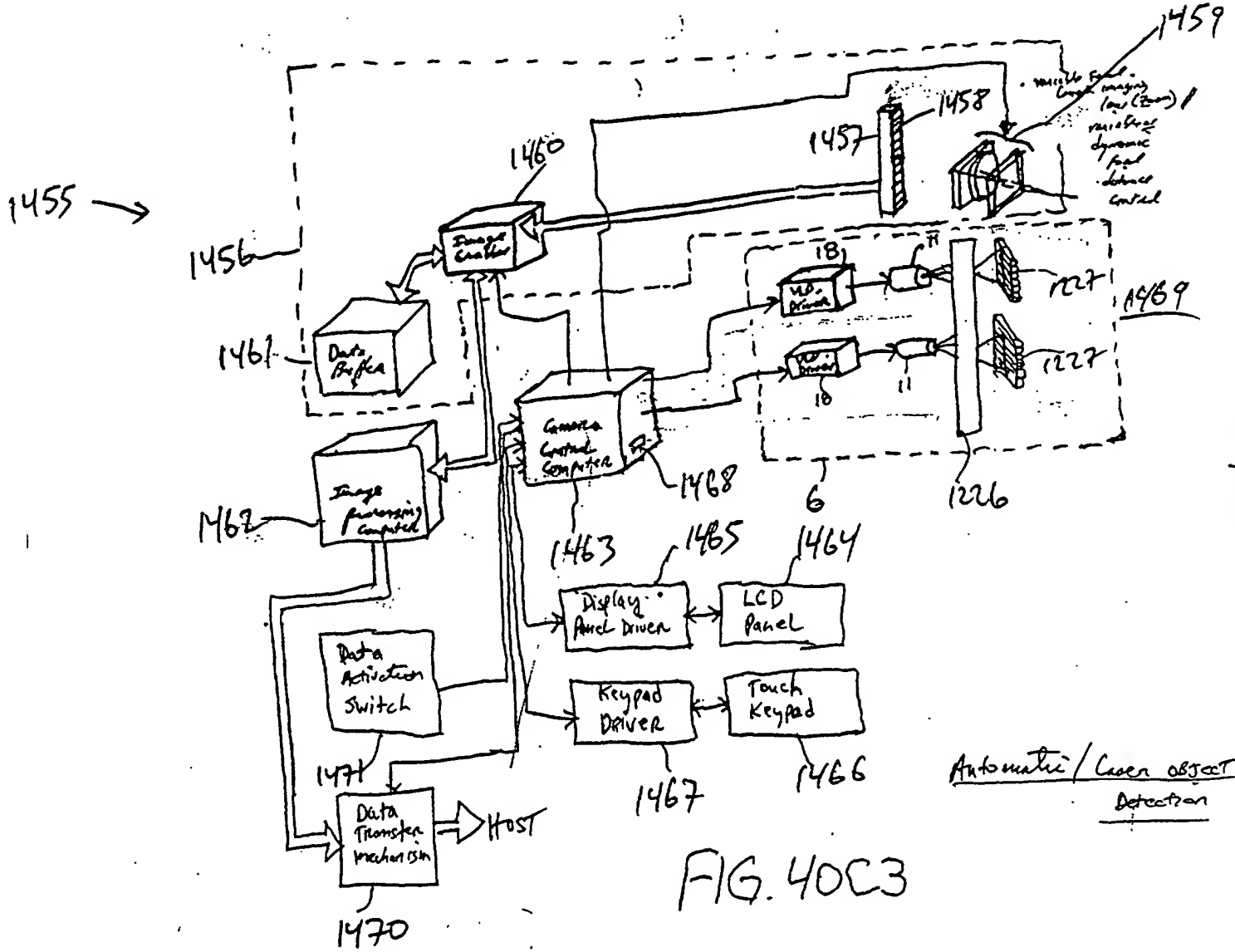
1455
1456
1459
1458
1457
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1226
1227
1227
6
18
Data Buffer
Image Processing Computer
Camera Control Computer
Display Panel Driver
LCD Panel
Keypad DRIVER
Touch Keypad
Data Activation Switch
Data Transfer Mechanism
HOST
Automatic / Laser object Detection

FIG. 40C3

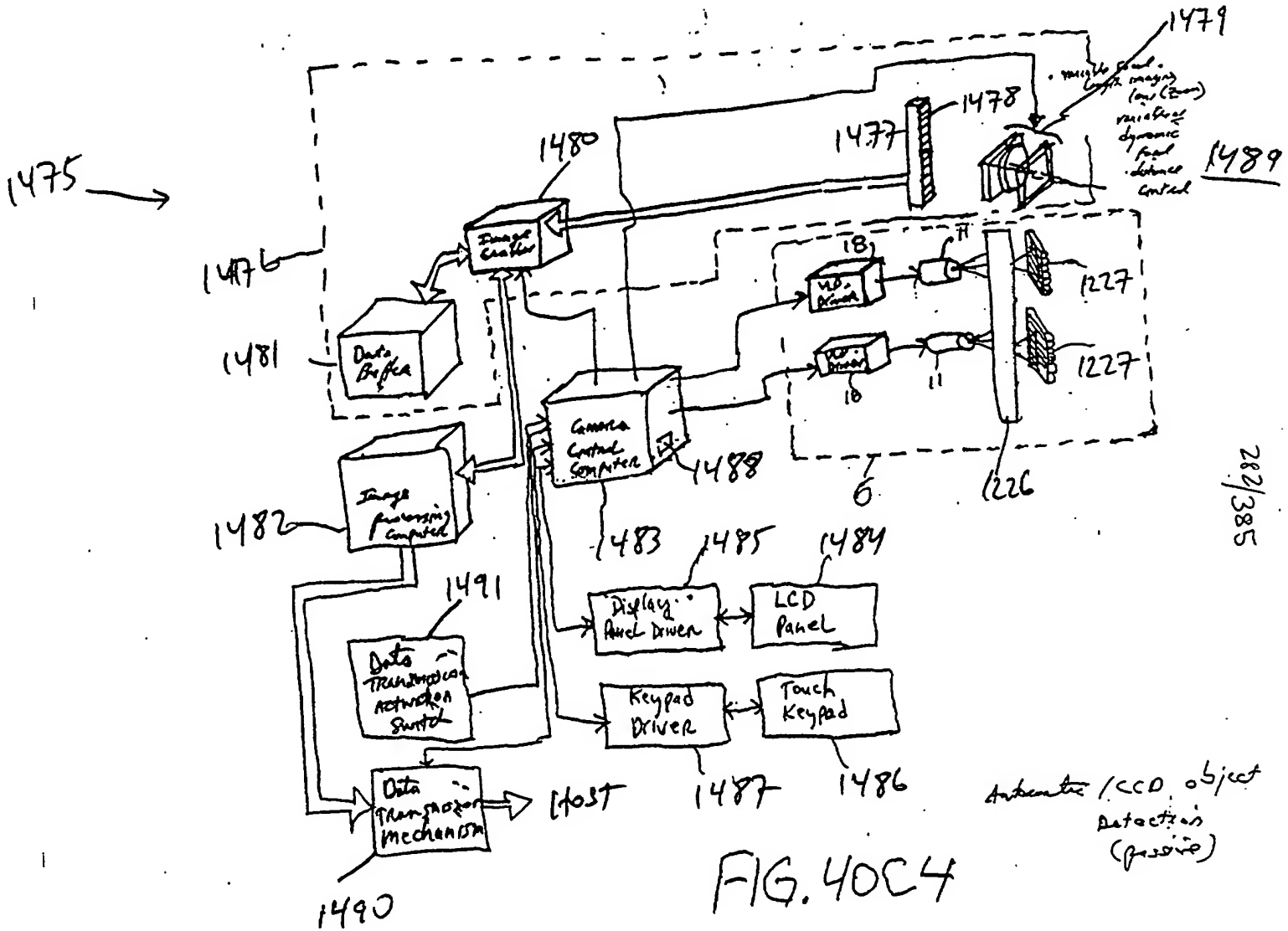

FIG. 40C4

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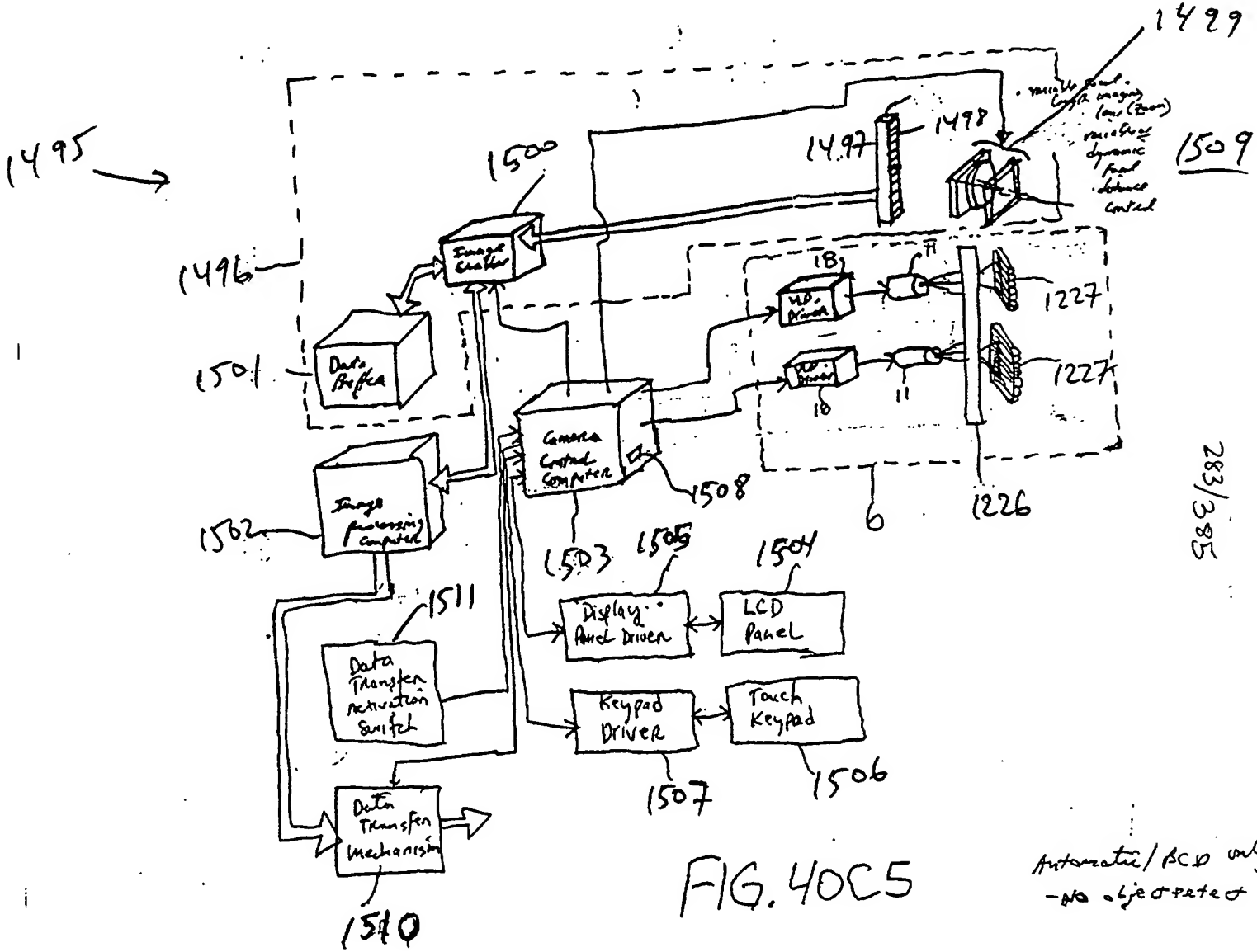

FIG. 40C5

Automatic/BCD only
-No objects

20020126210 "2020-04-08 07:07:07"

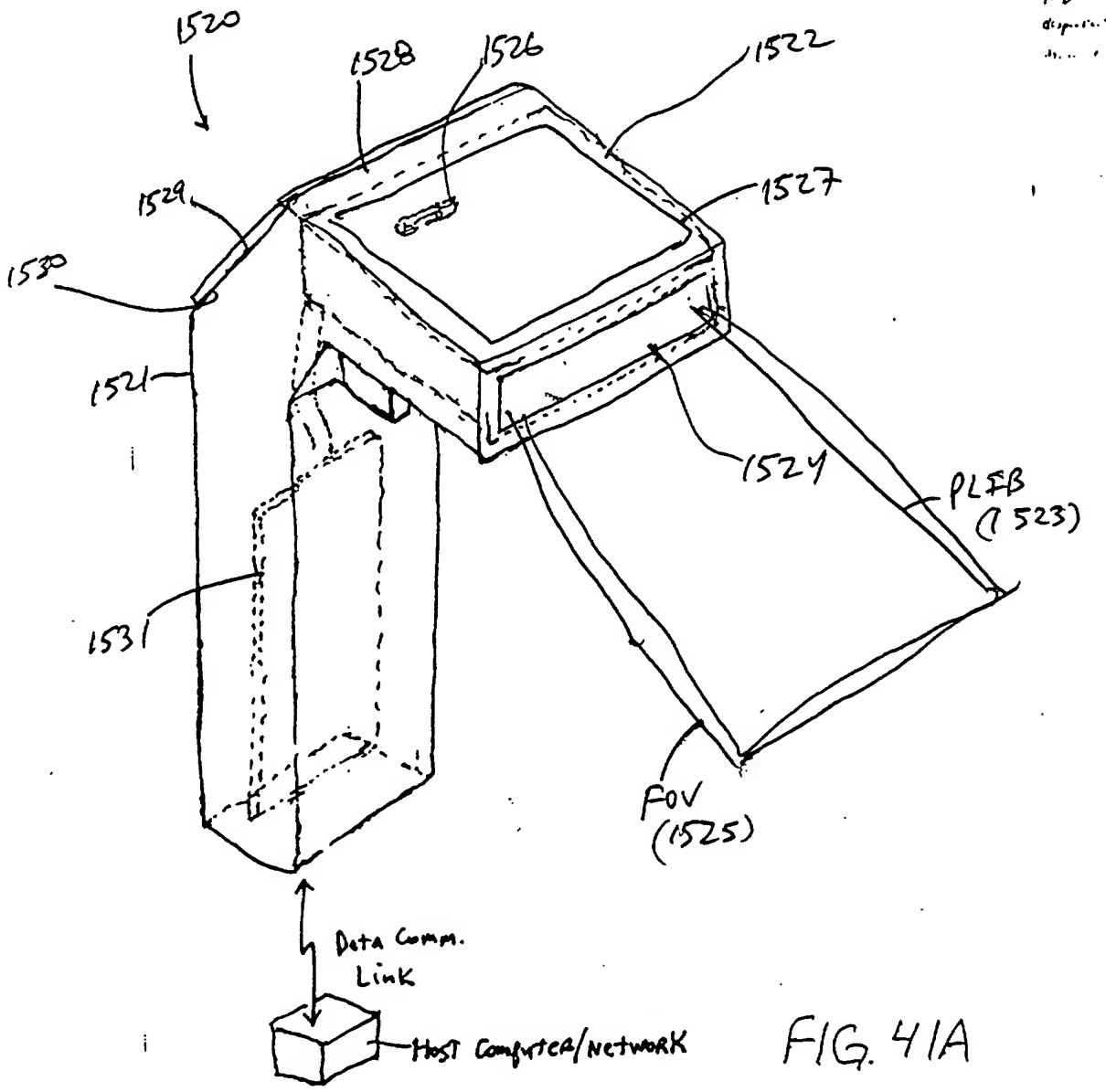
1520
1528
1526
1522
1529
1527
1530
1521
1524
PLIB
(1523)
1531
FOV
(1525)
Data Comm.
Link
Host Computer/Network

FIG. 41A

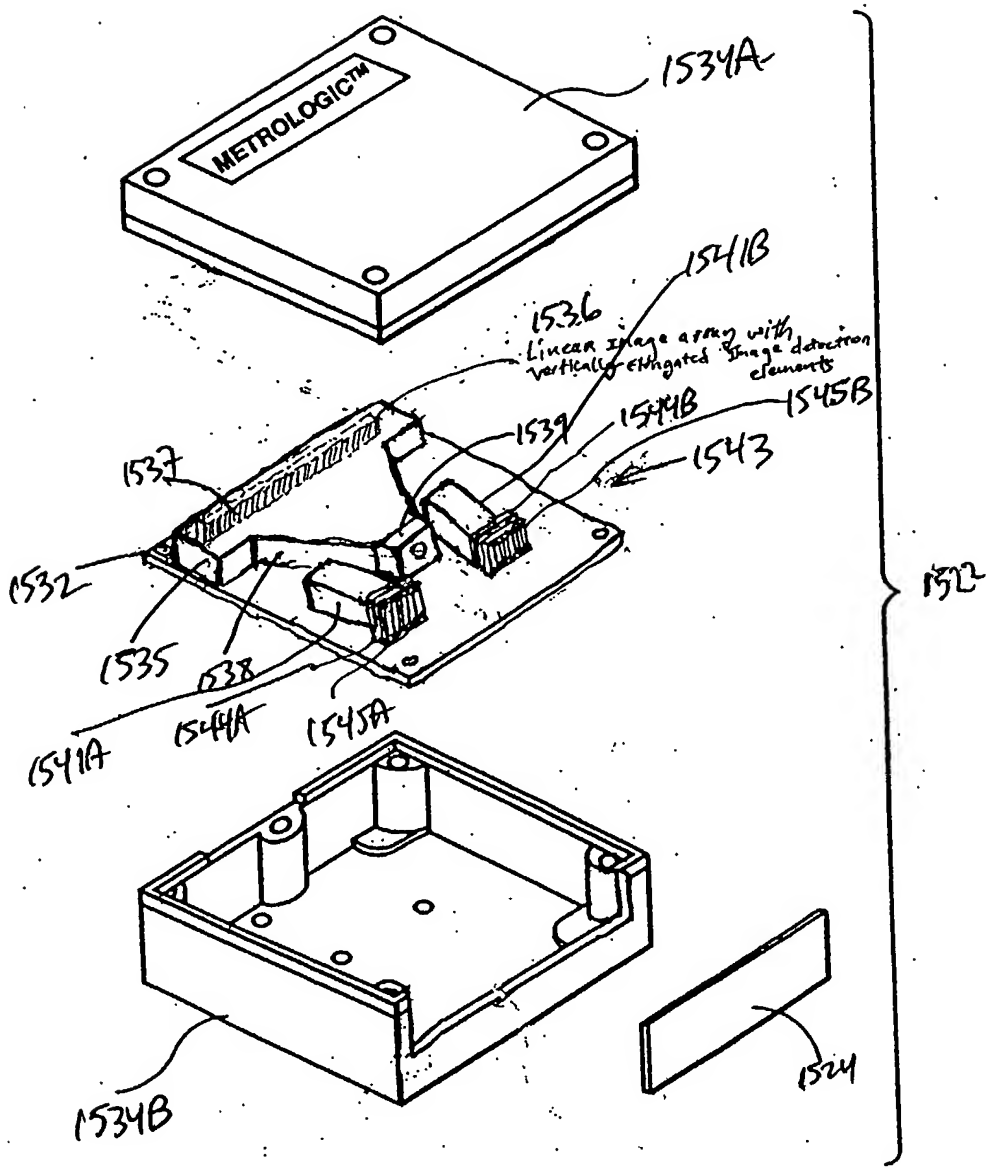
METROLOGIC™
1534A
1541B
1536
Linear image array with vertically elongated image detection elements
1539
1544B
1545B
1543
1537
1532
1535
1538
1541A
1544A
1545A
1534B
1524
152

FIG. 41B

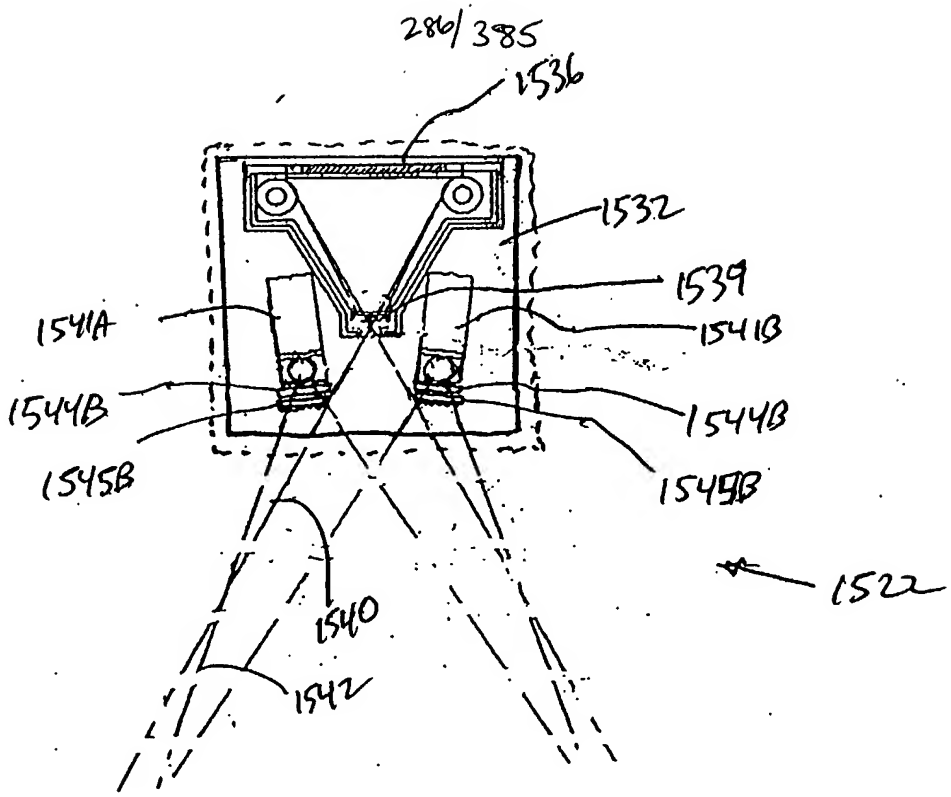

FIG. 41C

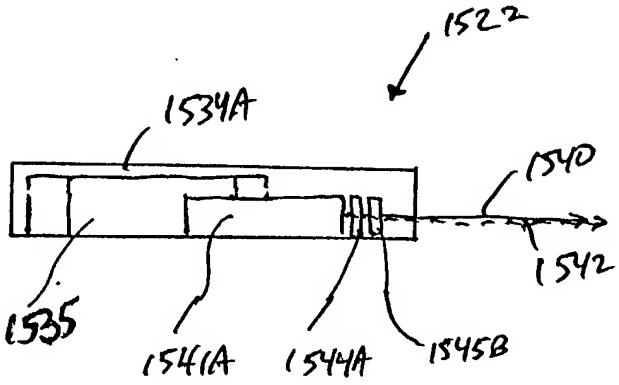

FIG. 41D

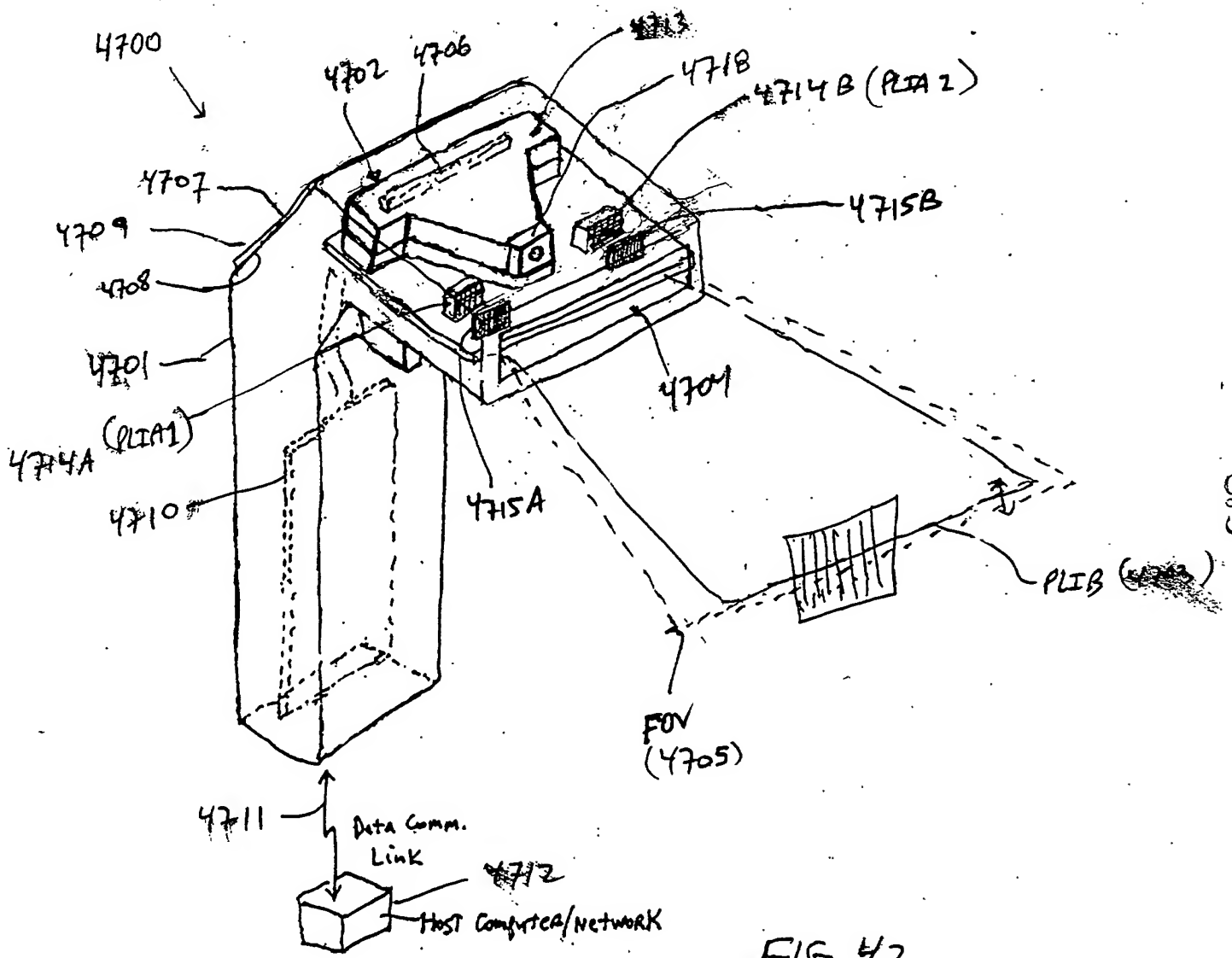

FIG 42

287885

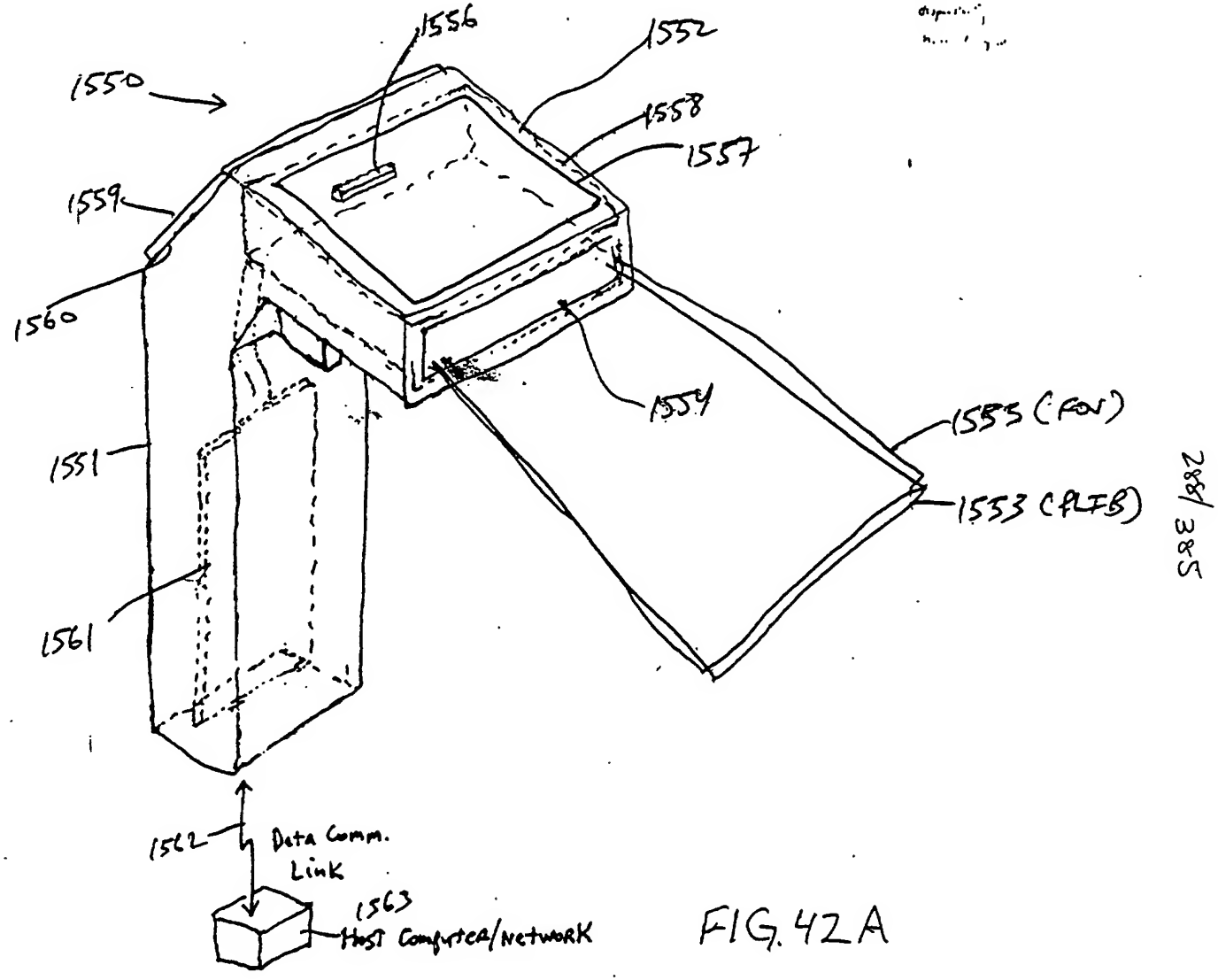
1556
1552
1550
1558
1557
1559
1560
1554
1555 (FOV)
1551
1553 (FIB)
1561
1562
Data Comm. Link
1563
Host Computer/Network

FIG. 42A

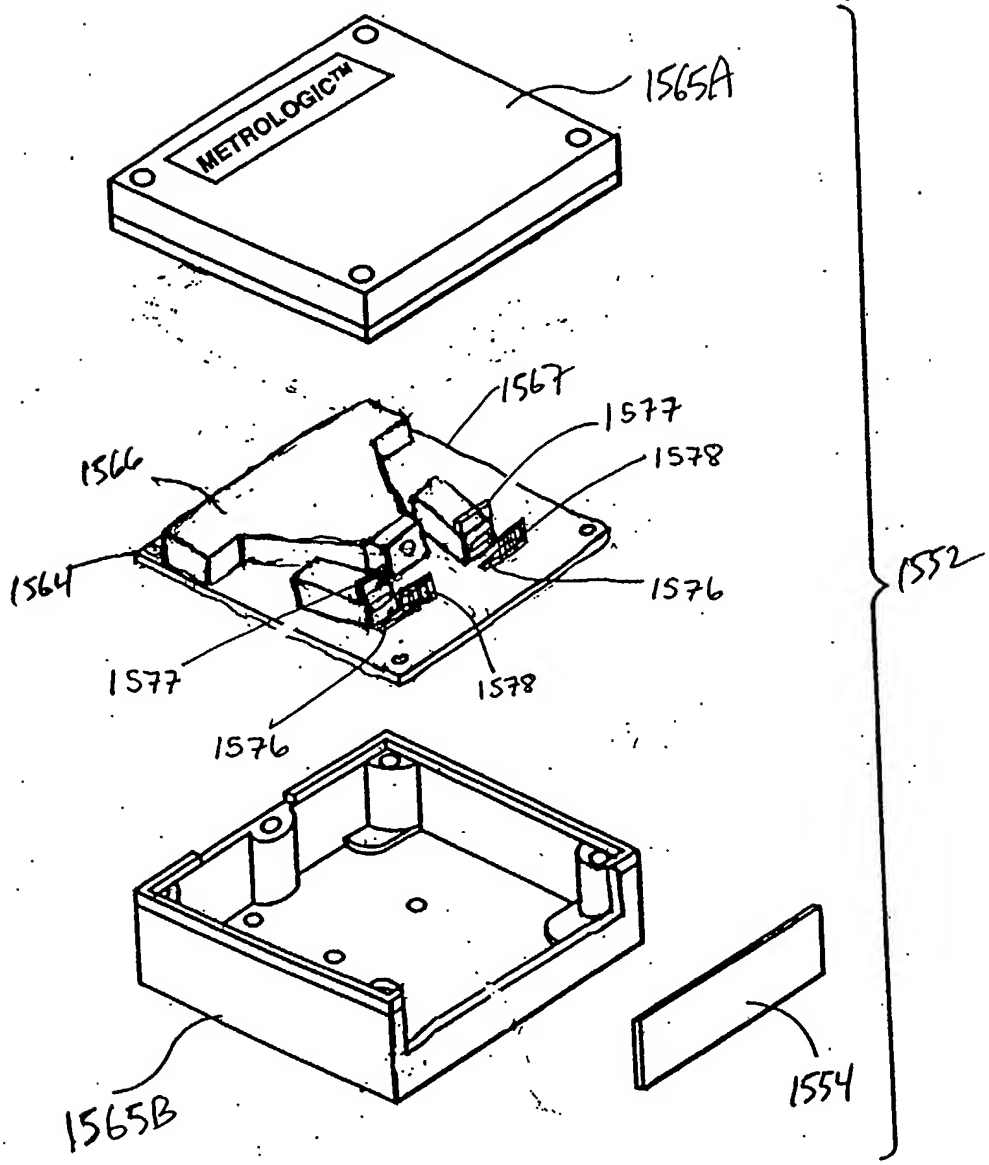
METROLOGIC™
1565A
1567
1577
1578
1566
1564
1576
1577
1578
1576
1552
1565B
1554

FIG. 42B

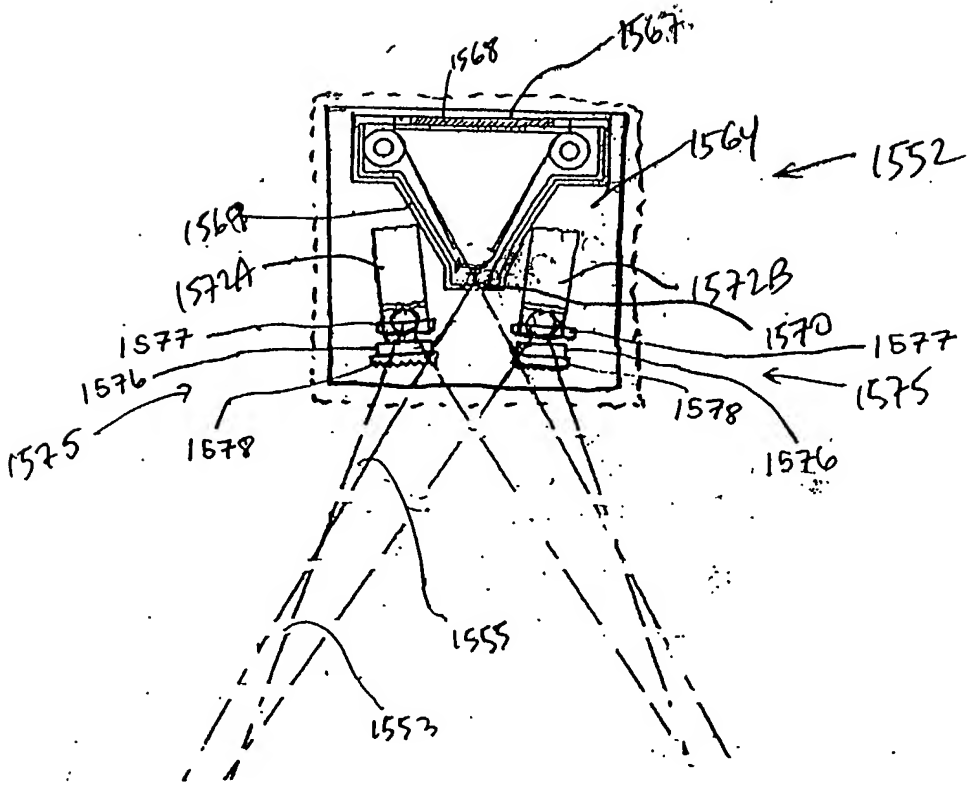

FIG. 42C

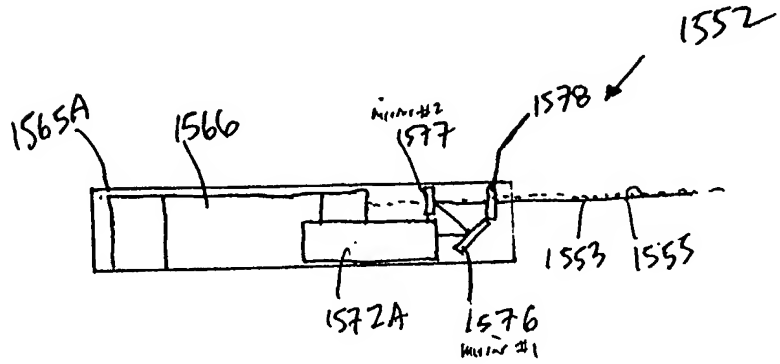

FIG. 42D

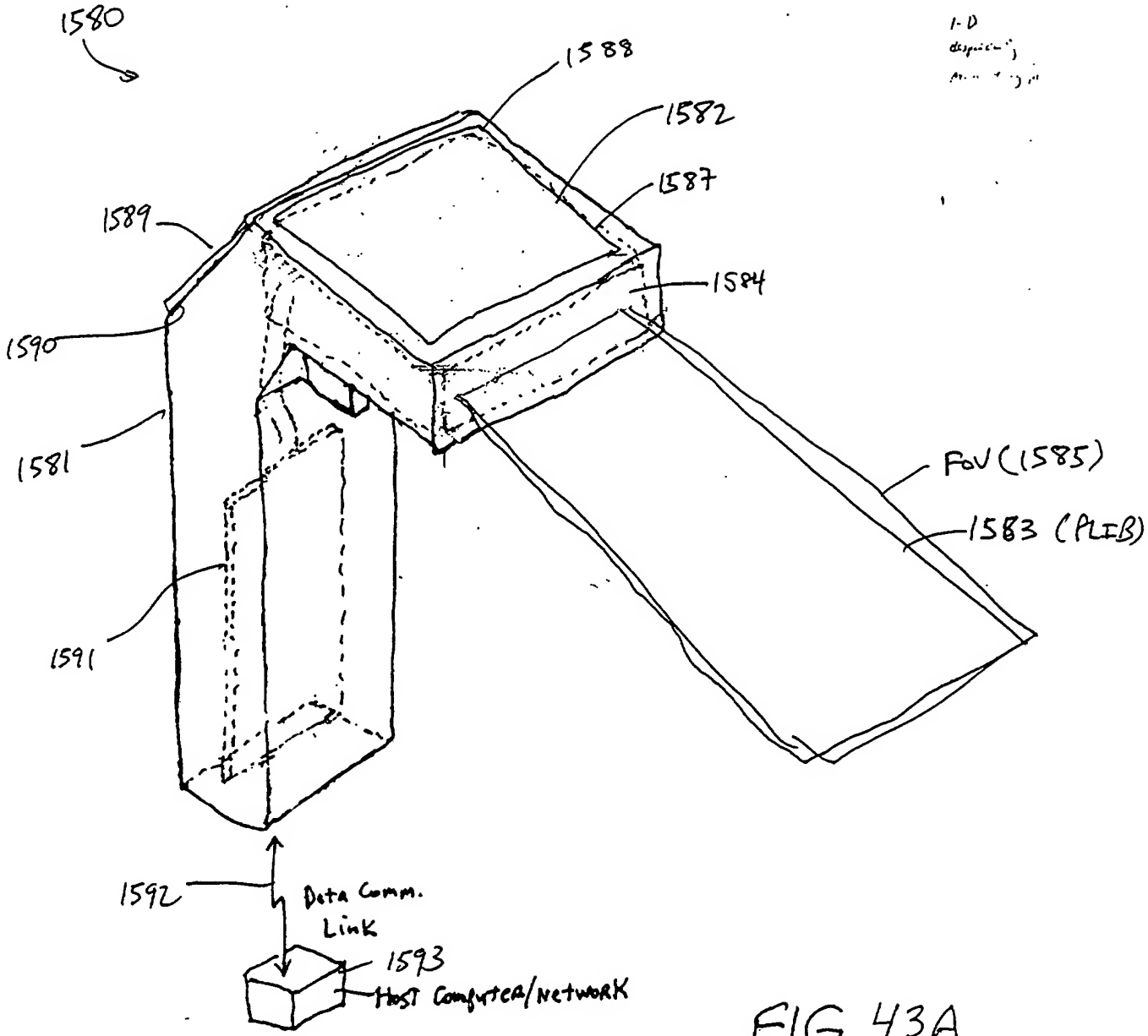

FIG. 43A

WO 2022/060920 PCT/US2021/050974

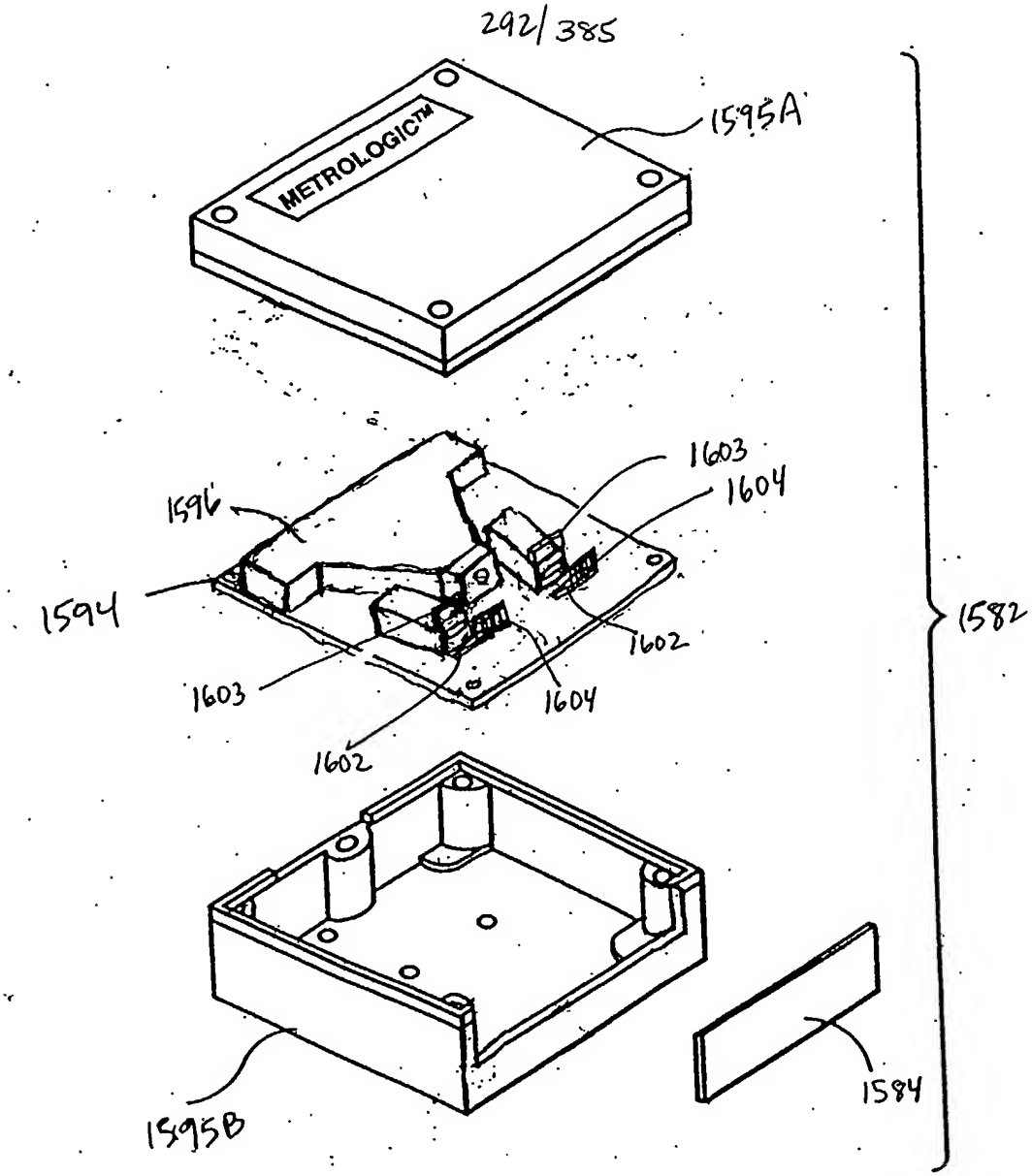
292/385
METROLOGIC™
1595A
1603
1604
1596
1594
1602
1603
1604
1602
1582
1595B
1584

FIG. 43

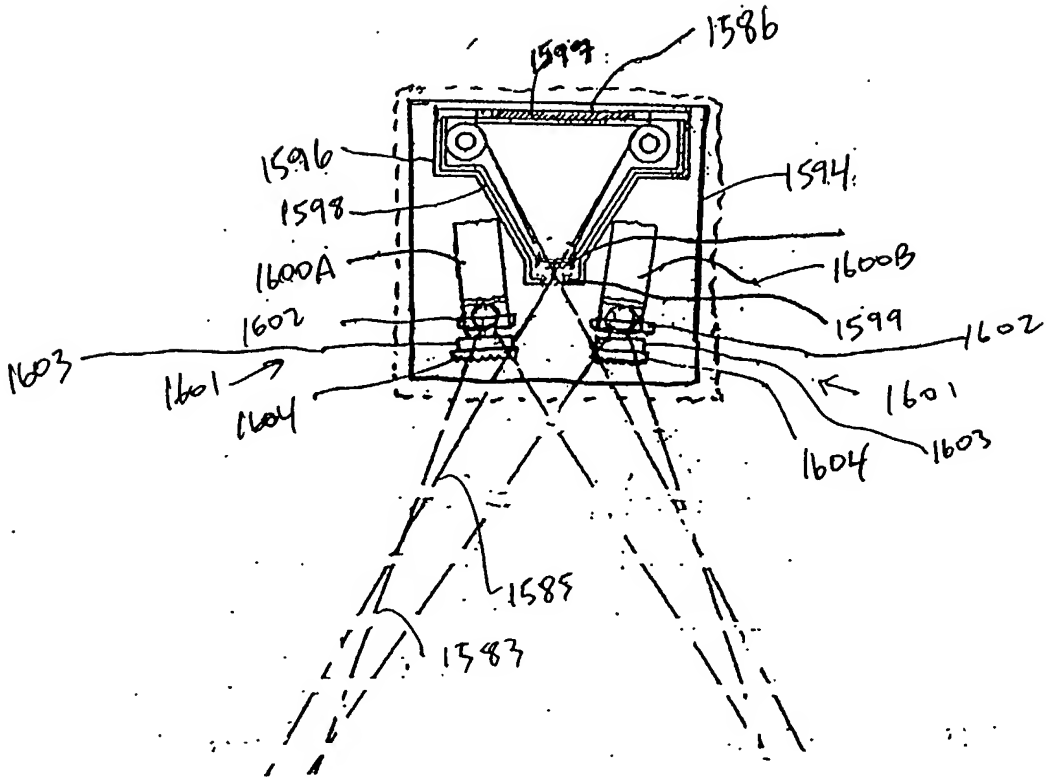

FIG. 43C

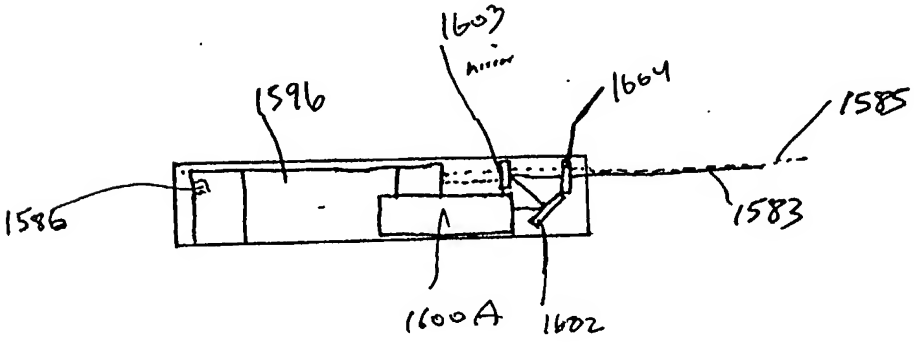

FIG. 43D

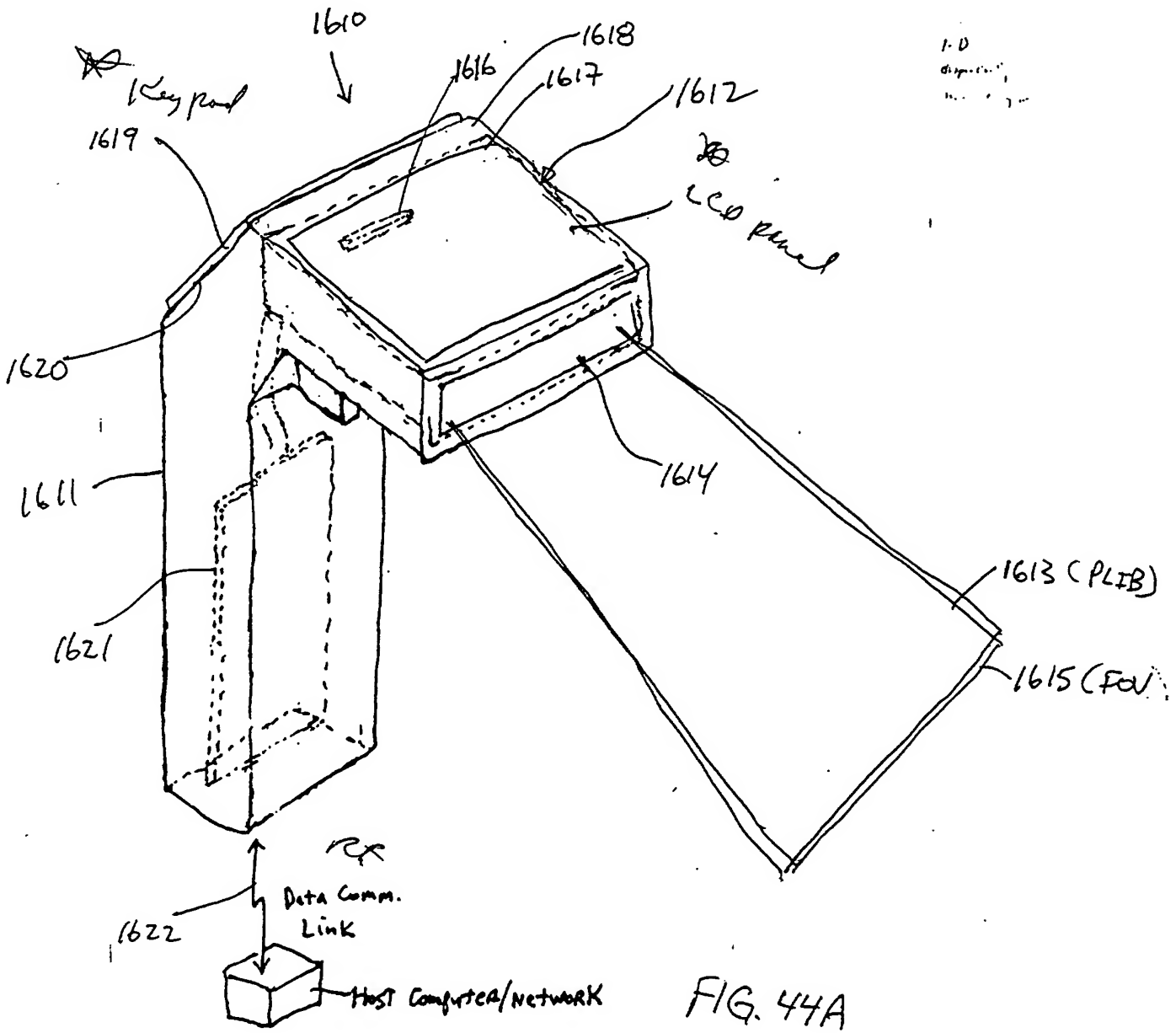

FIG. 44A

1008448827 - 062707

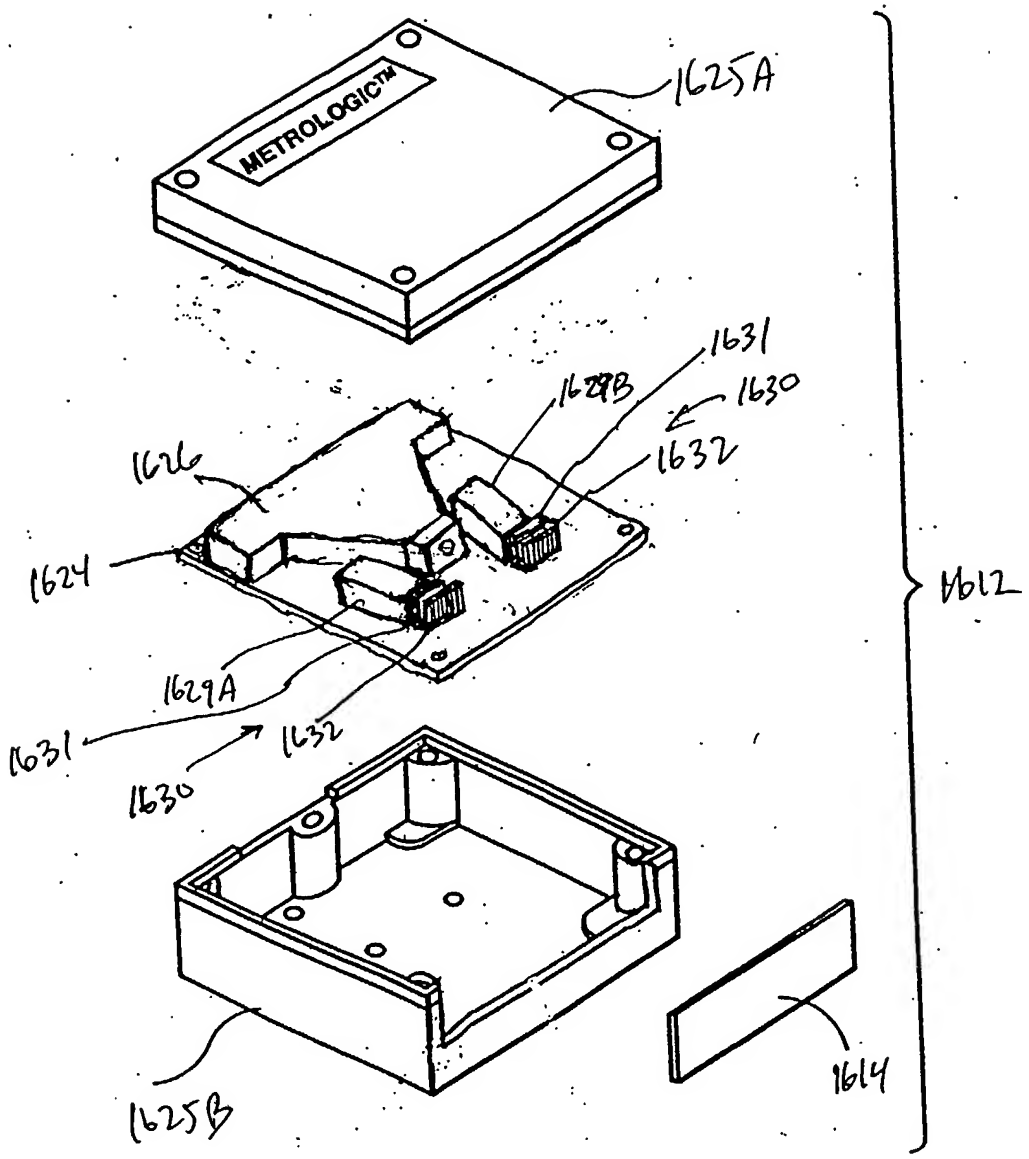
METROLOGIC™
1625A
1631
1629B
1630
1632
1626
1624
1629A
1631
1632
1630
1612
1625B
1614

FIG. 44B

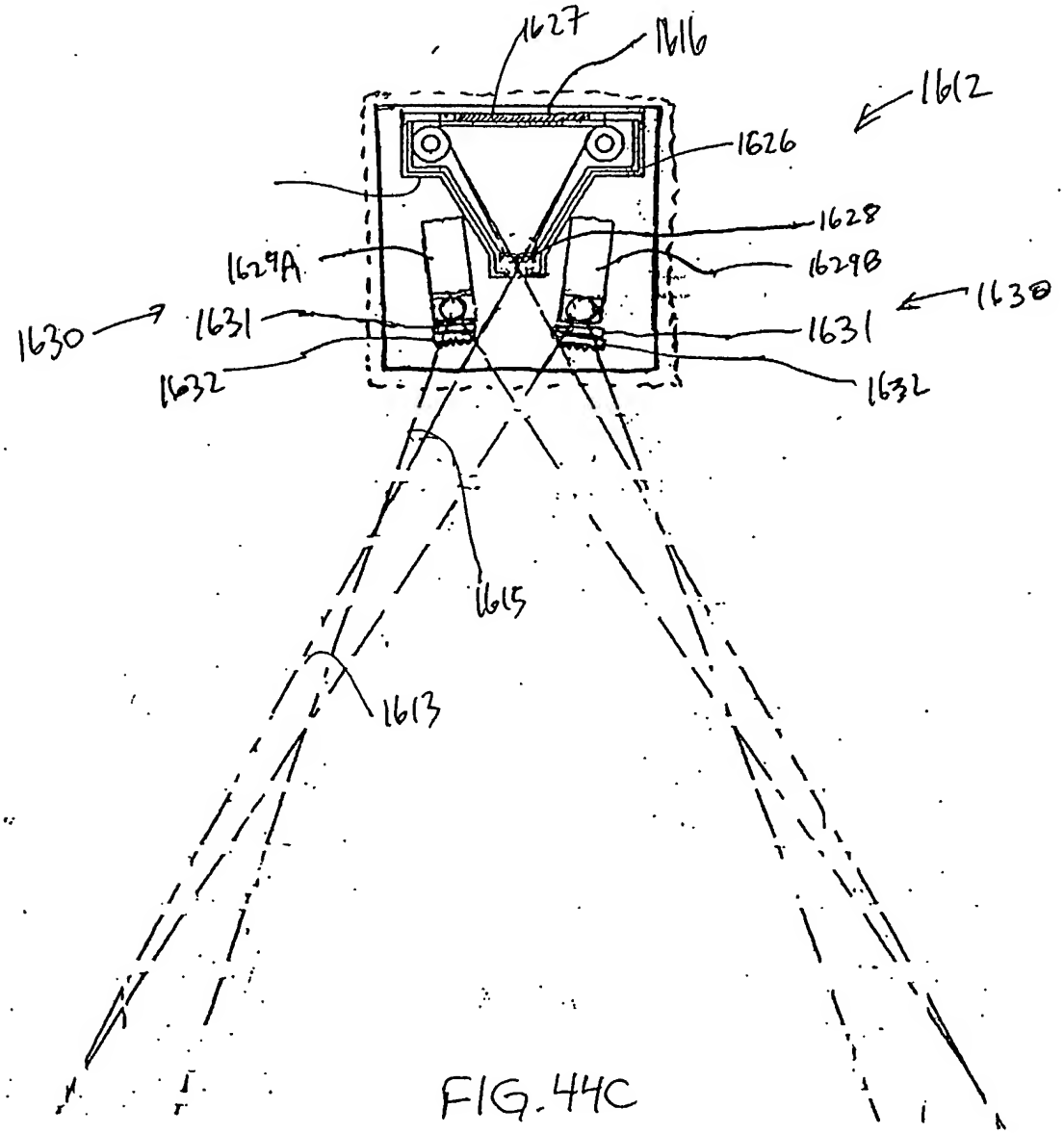
1627
1616
1612
1626
1628
1629A
1629B
1630
1631
1631
1630
1632
1632
1615
1613

FIG. 44C

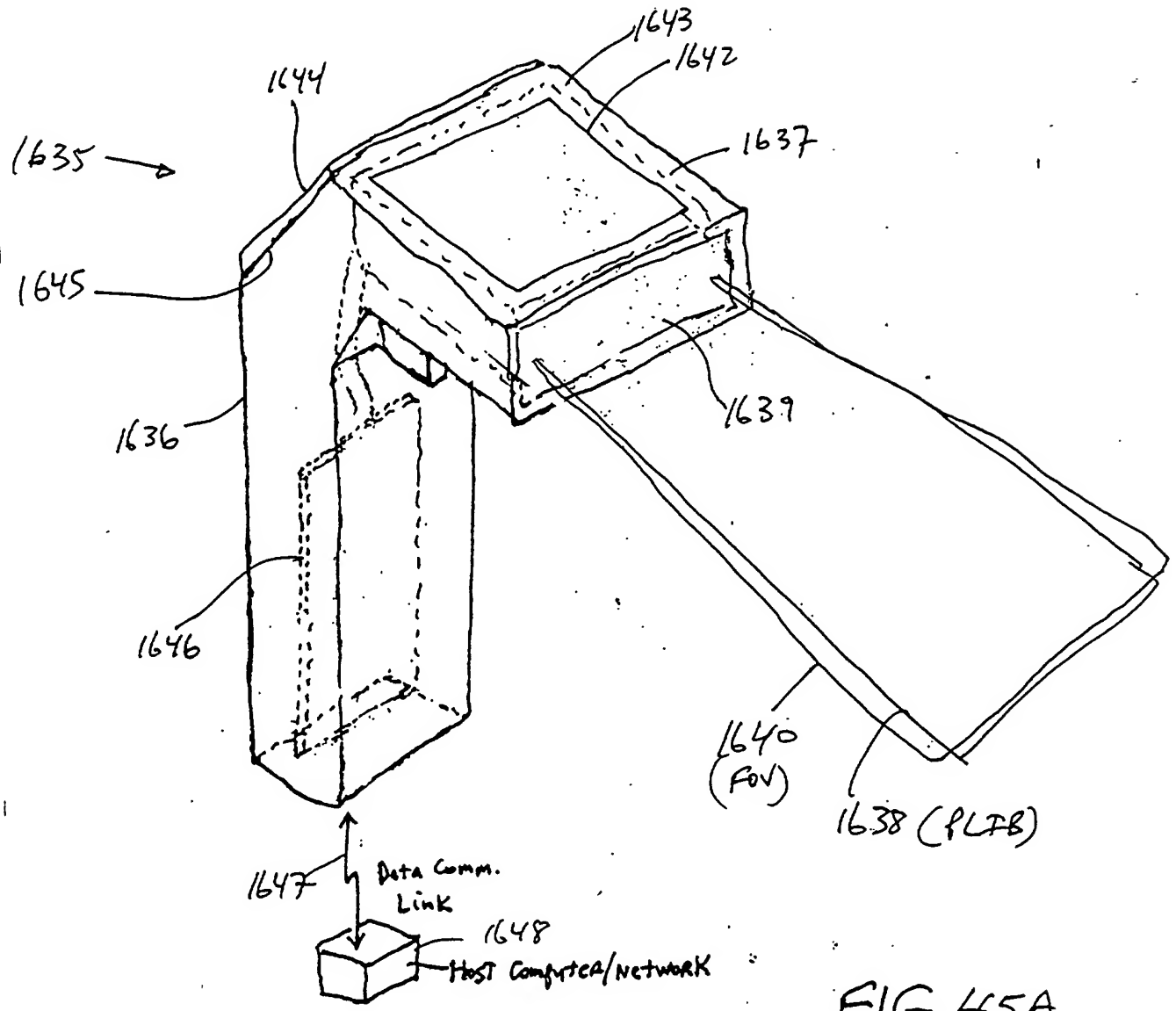
1643
1642
1644
1635
1637
1645
1639
1636
1646
1640
(FOV)
1638 (PLIB)
1647
Data Comm.
Link
1648
Host Computer/Network

FIG. 45A

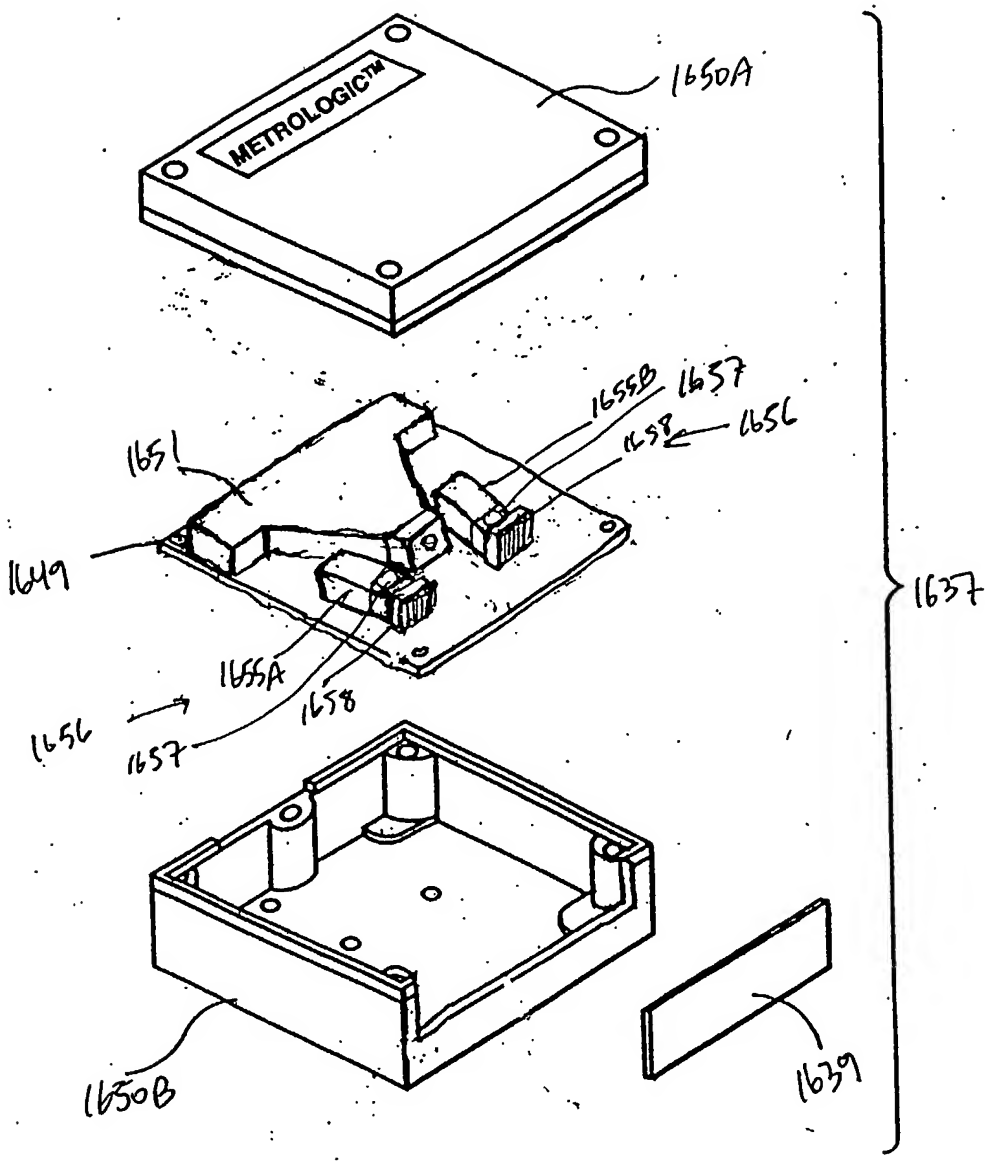
METROLOGIC™
1650A
1655B
1657
1658
1656
1651
1649
1655A
1658
1656
1657
1637
1650B
1639

FIG. 45B

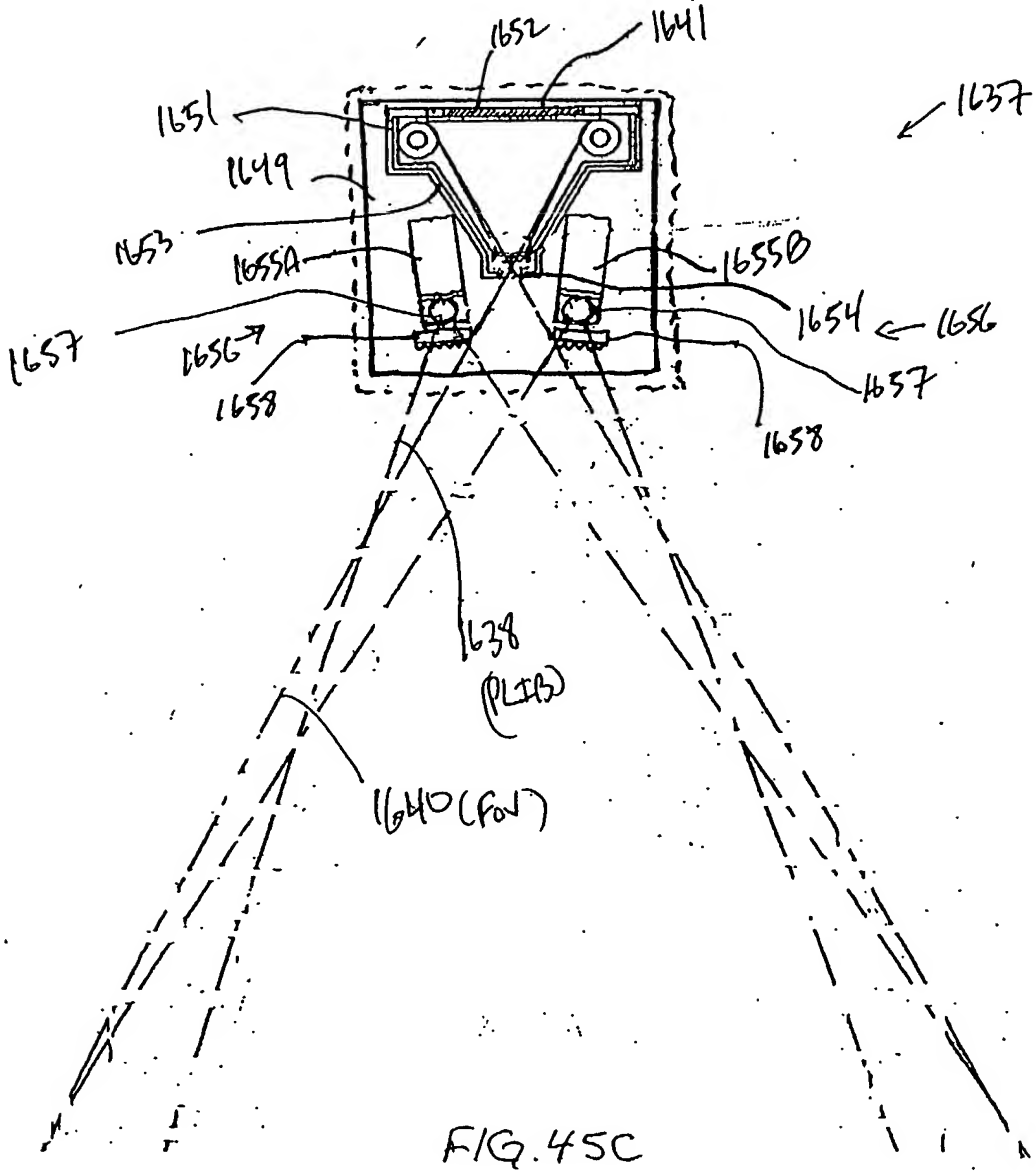
1652
1641
1651
1637
1649
1653
1655A
1655B
1654
1656
1657
1656
1658
1657
1658
1638
(PLIB)
1640 (FOV)

FIG. 45C

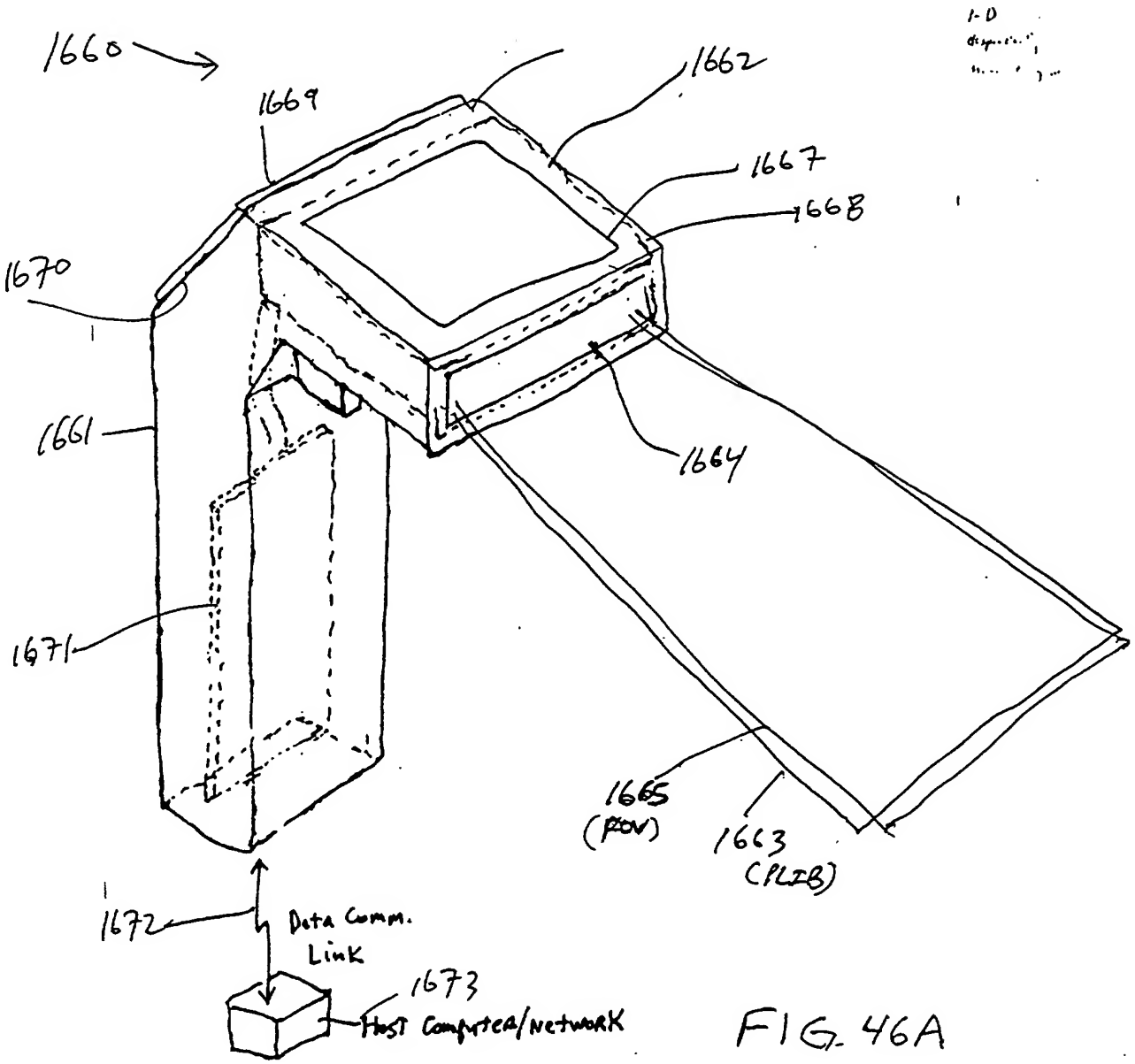
1660
1669
1662
1667
1668
1670
1661
1664
1671
1665
(POV)
1663
(PLIB)
1672
Data Comm.
Link
1673
Host Computer/Network

FIG. 46A

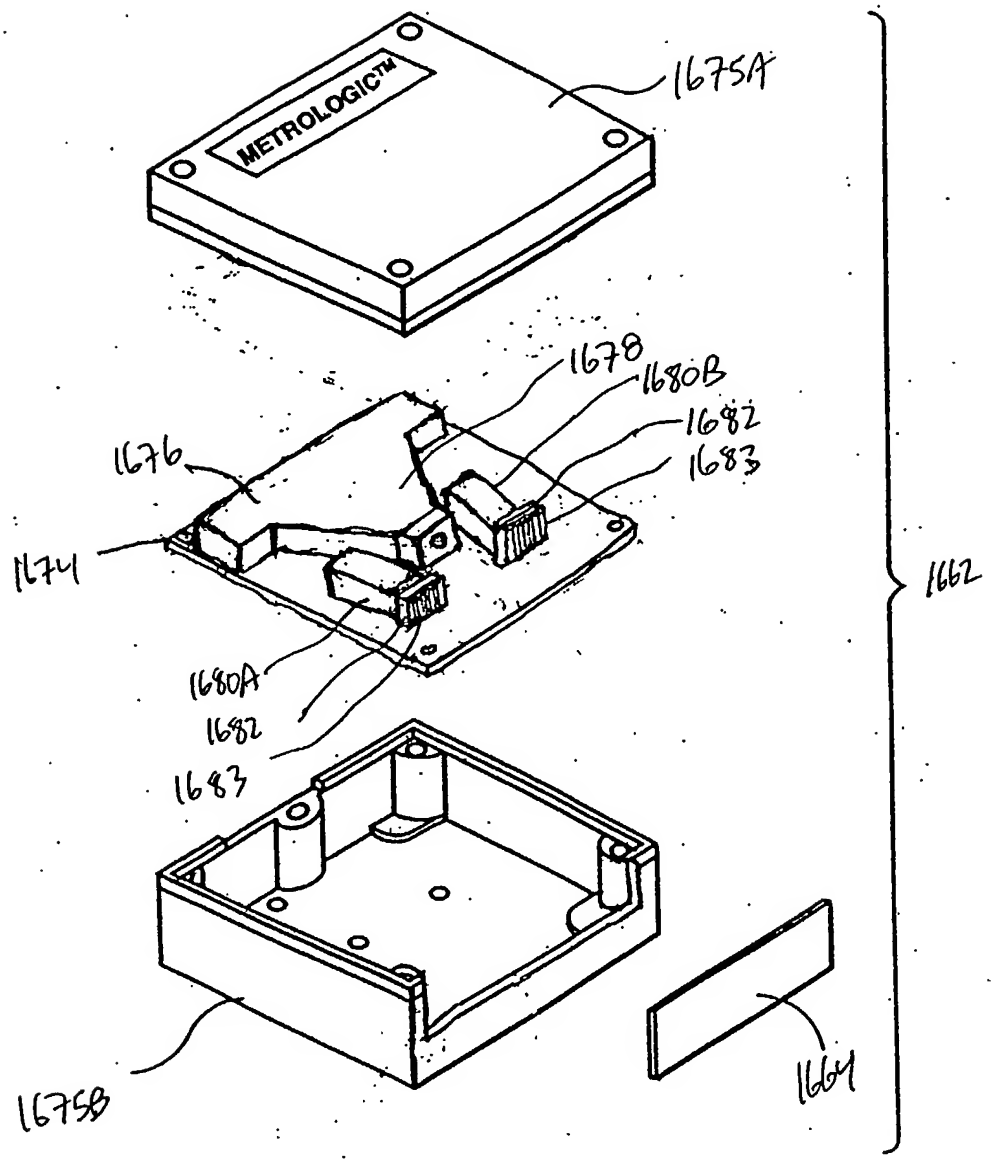
METROLOGIC™
1675A
1678
1680B
1682
1683
1676
1674
1680A
1682
1683
1662
1675B
1664

FIG. 46B

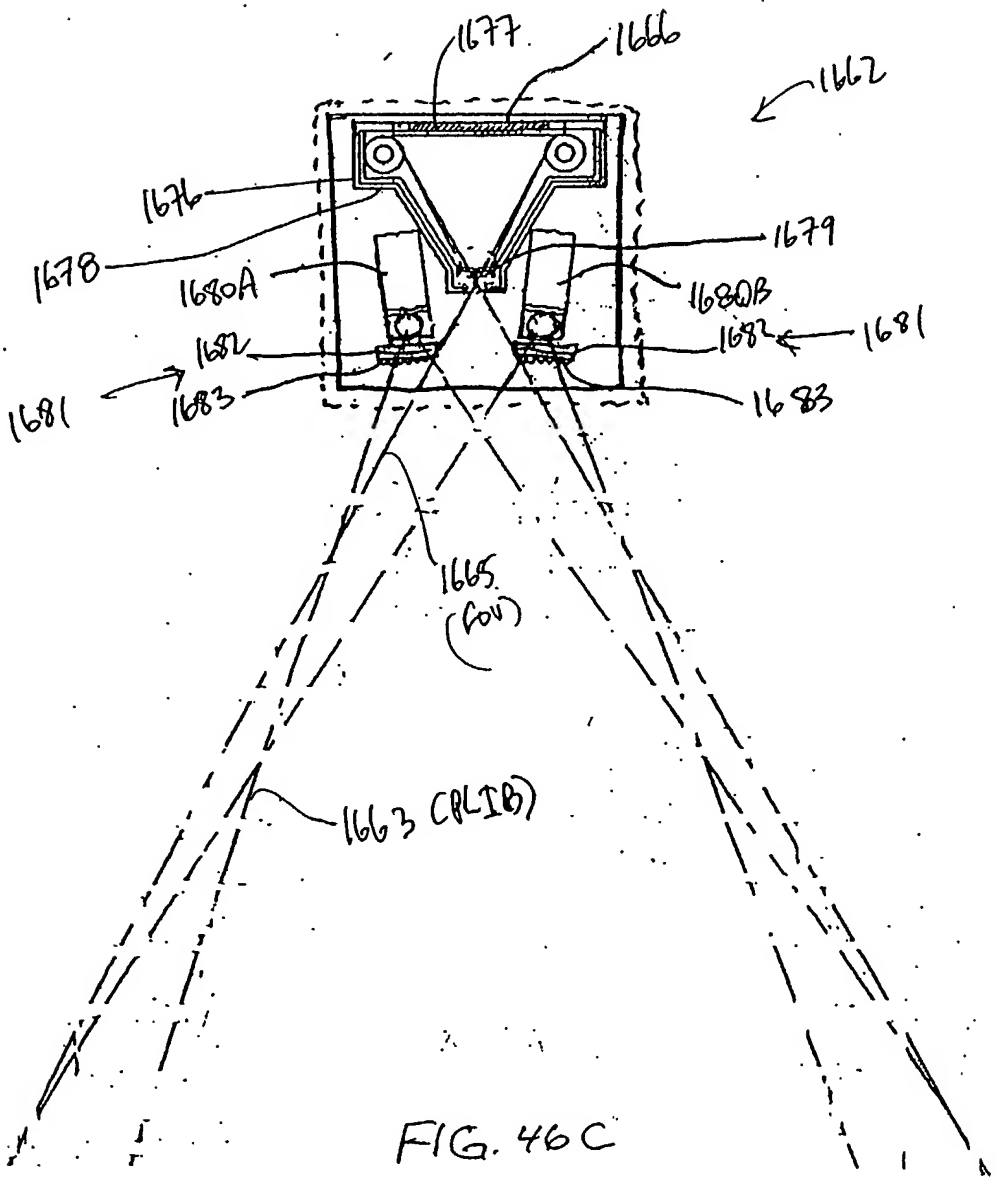
1677
1666
1662
1676
1678
1679
1680A
1680B
1682
1681
1681
1683
1683
1665
(COV)
1663 (PLIB)

FIG. 46C

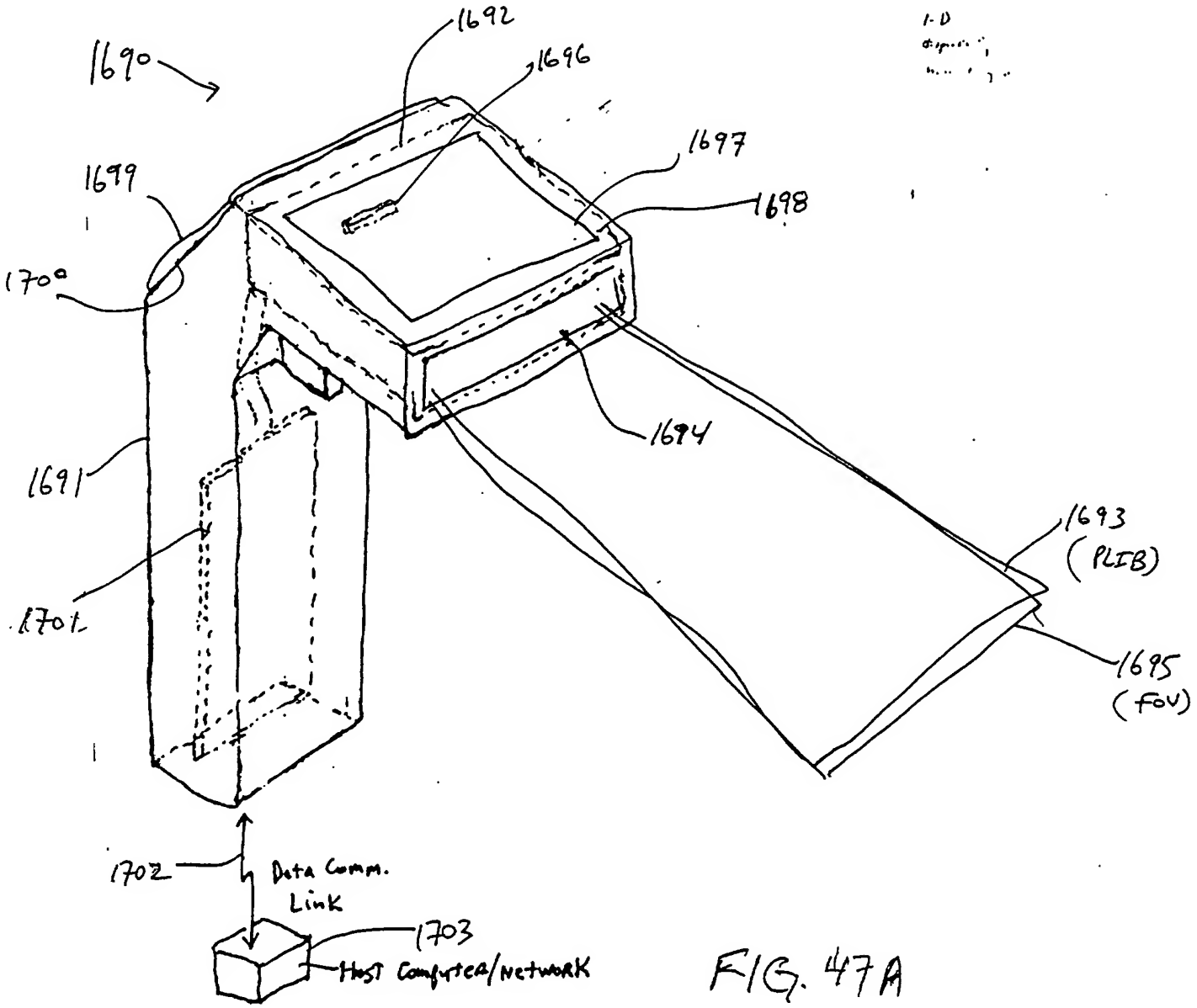
1690
1692
1696
1697
1699
1698
1700
1694
1691
1693
(PLIB)
1701
1695
(FOV)
1702
Data Comm.
Link
1703
Host Computer/Network

FIG. 47A

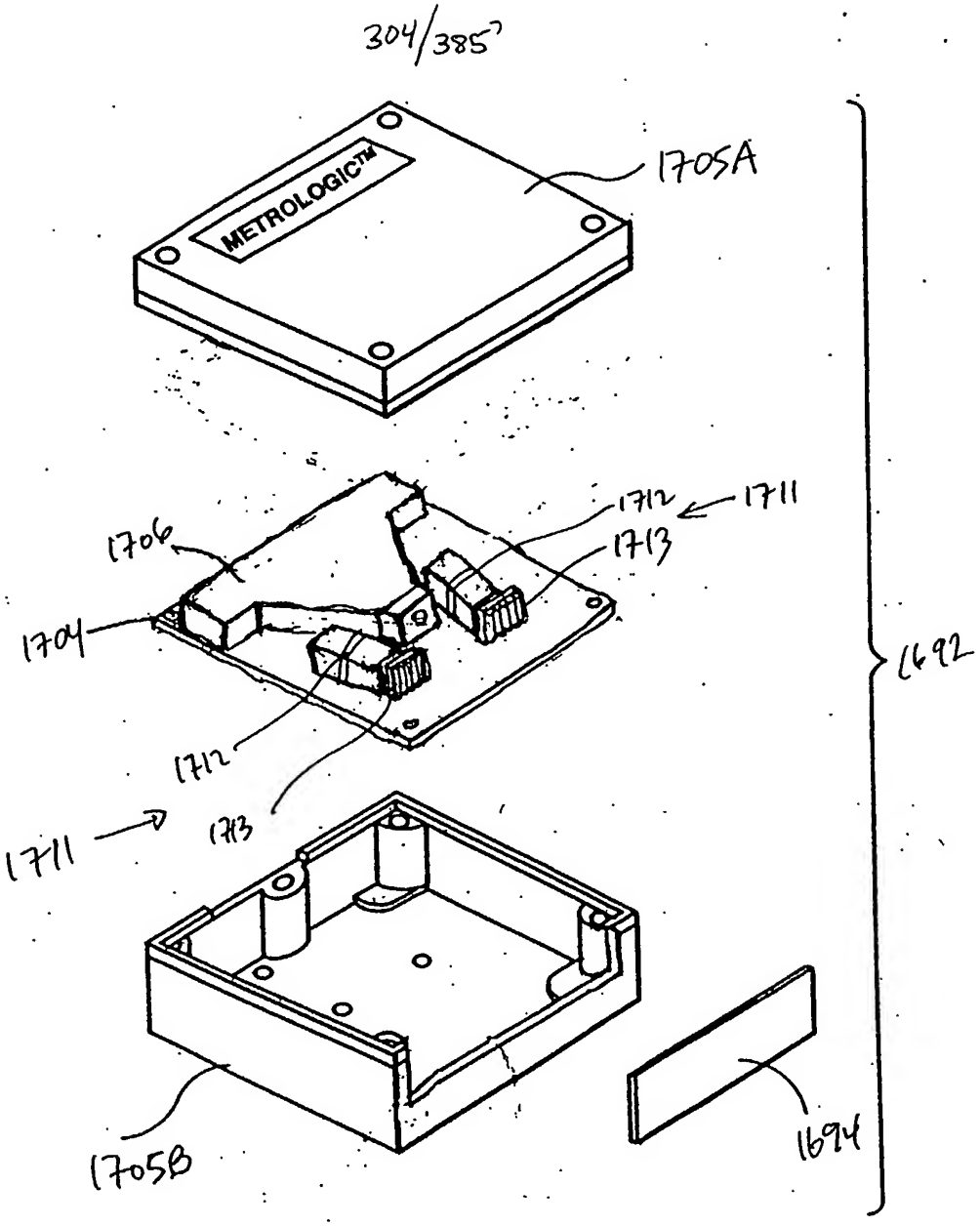
304/385
METROLOGIC™
1705A
1706
1712
1711
1713
1704
1712
1711
1713
1692
1705B
1694

FIG. 47B

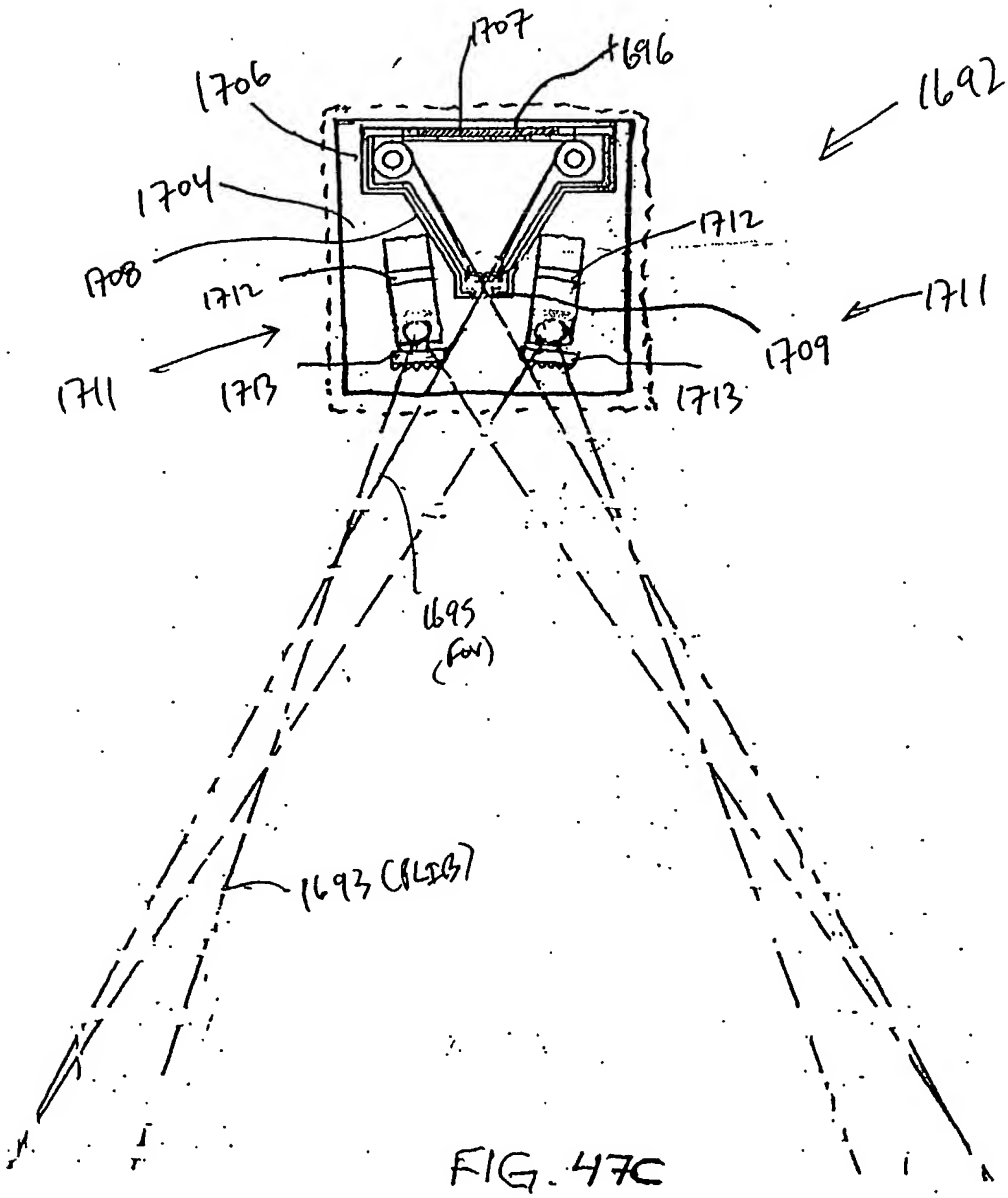
1707
1696
1706
1692
1704
1712
1708
1712
1711
1711
1709
1713
1713
1695
(FOV)
1693 (BEAM)

FIG. 47C

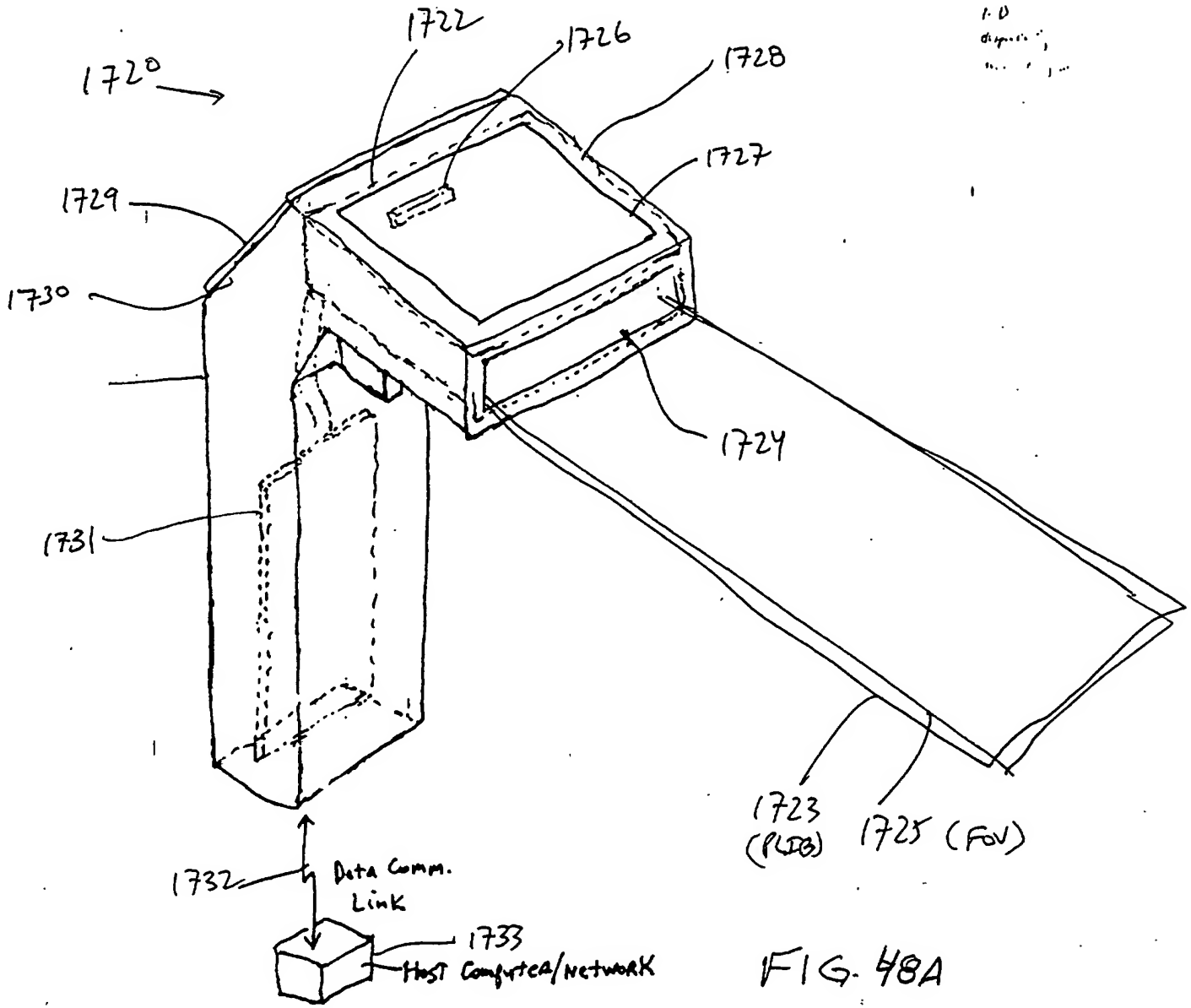
1720
1722
1726
1728
1727
1729
1730
1731
1724
1723
(PLIB)
1725 (FOV)
1732
Data Comm.
Link
1733
Host Computer/Network

FIG. 48A

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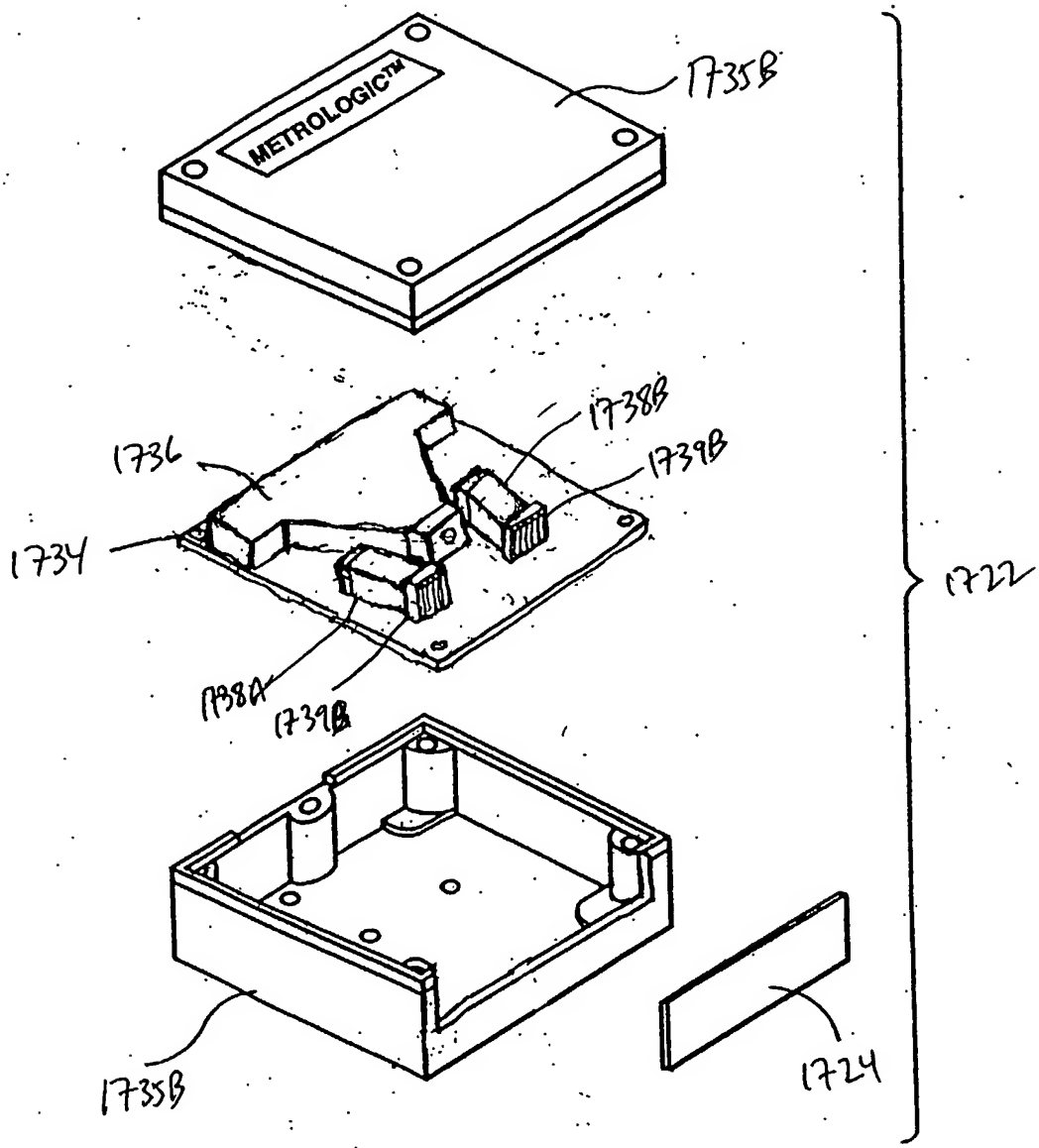

FIG. 48B

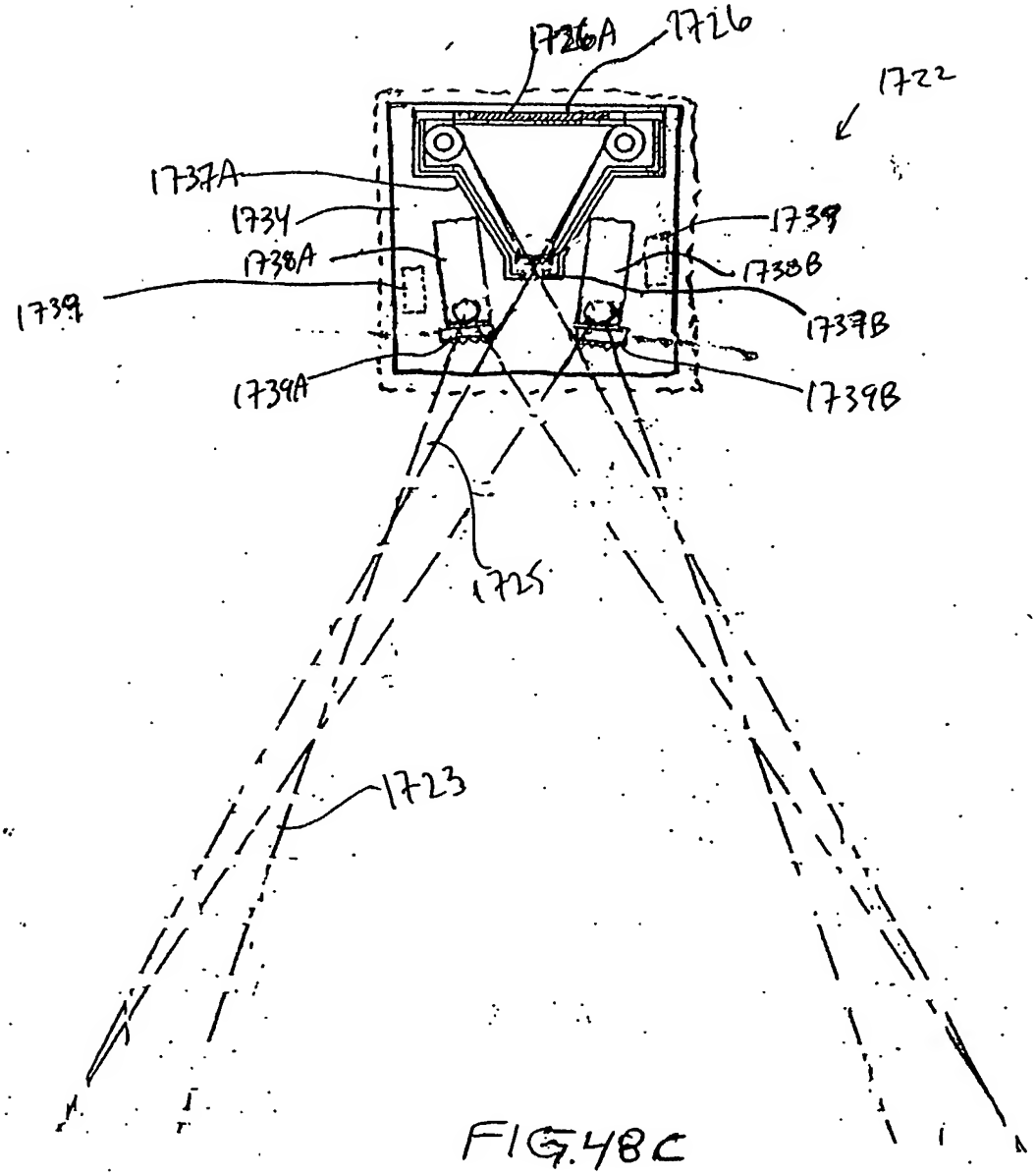
1726A
1726
1722
1737A
1734
1739
1738A
1738B
1739
1737B
1739A
1739B
1725
1723

FIG. 48C

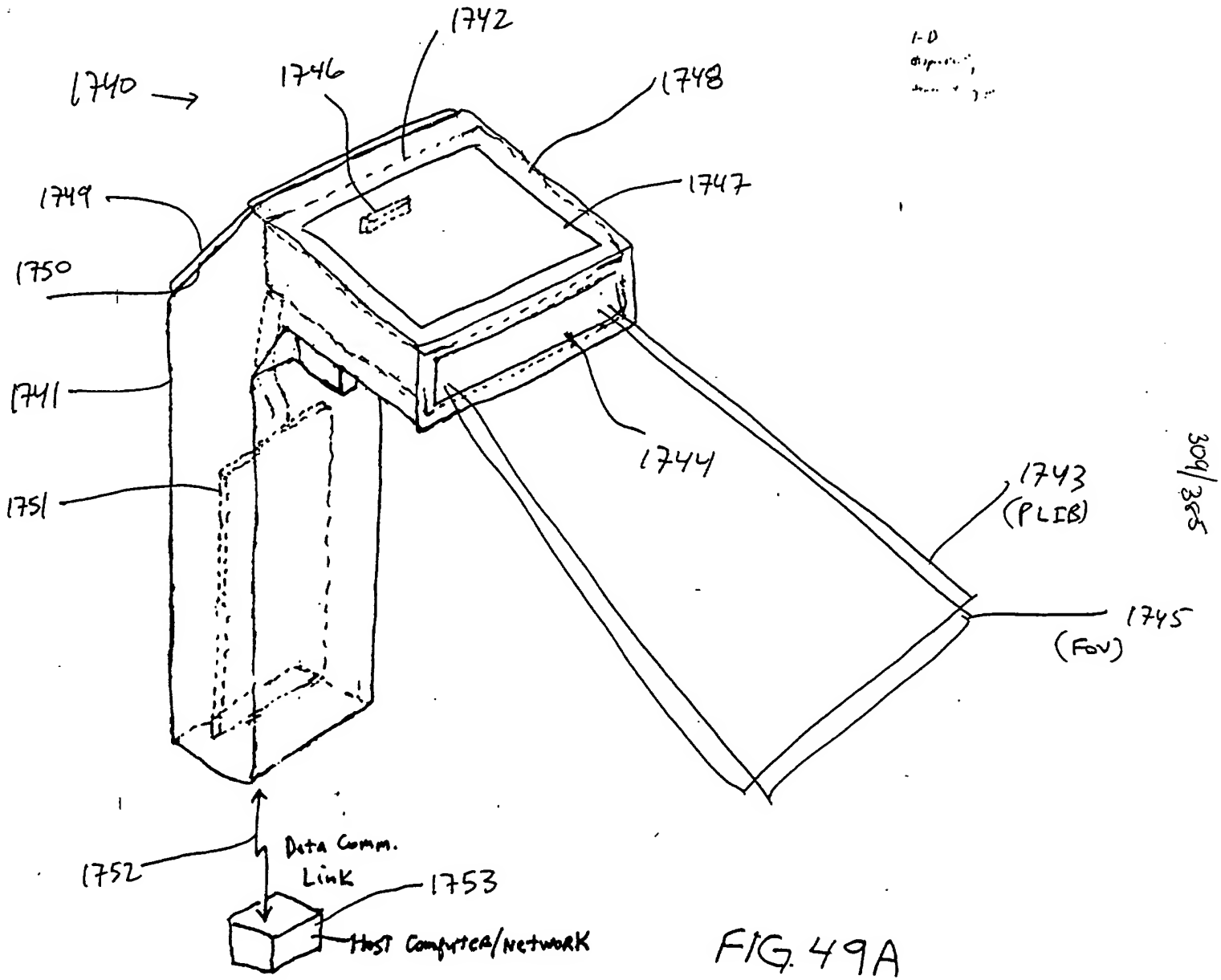

FIG. 49A

20220220 "2288+8607"

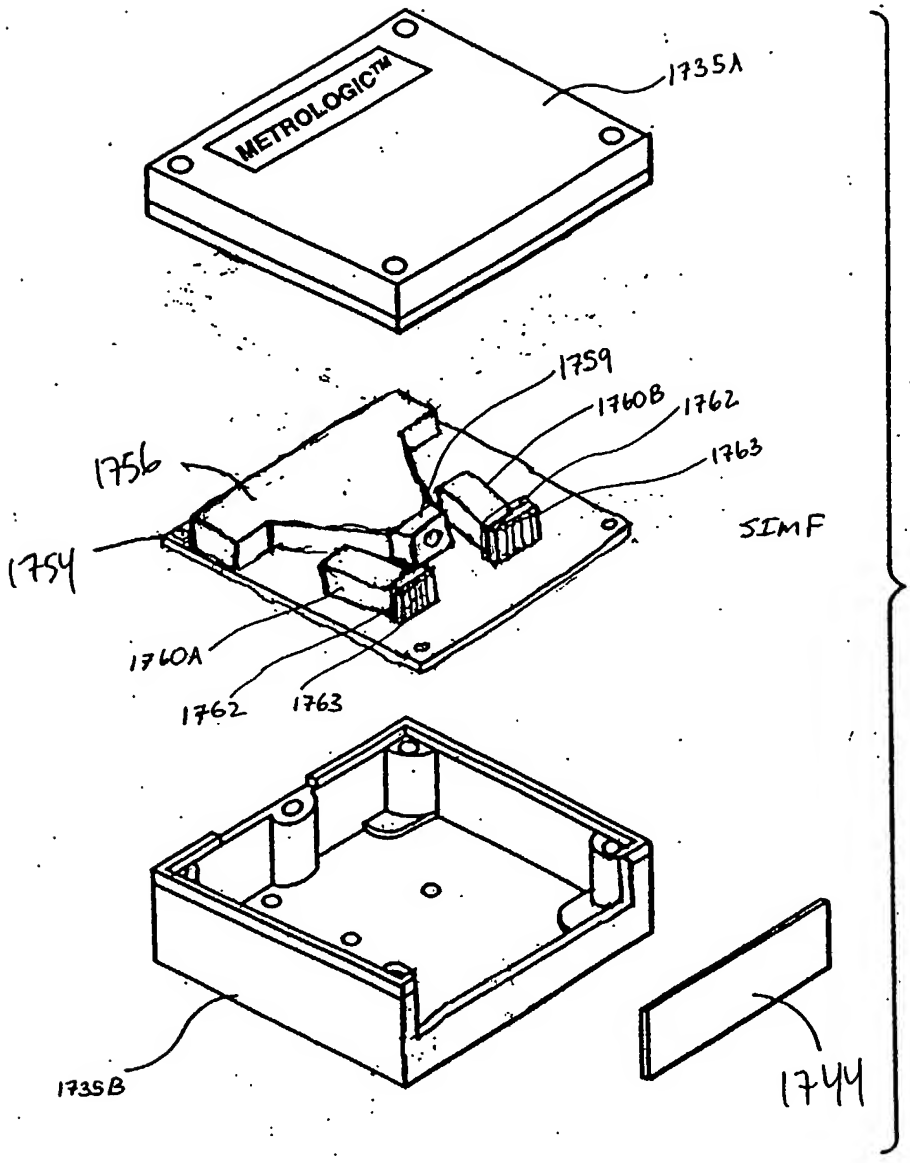
METROLOGIC™
1735A
1759
1760B
1762
1763
1756
1754
SIMF
1760A
1762
1763
1735B
1744

FIG. 49B

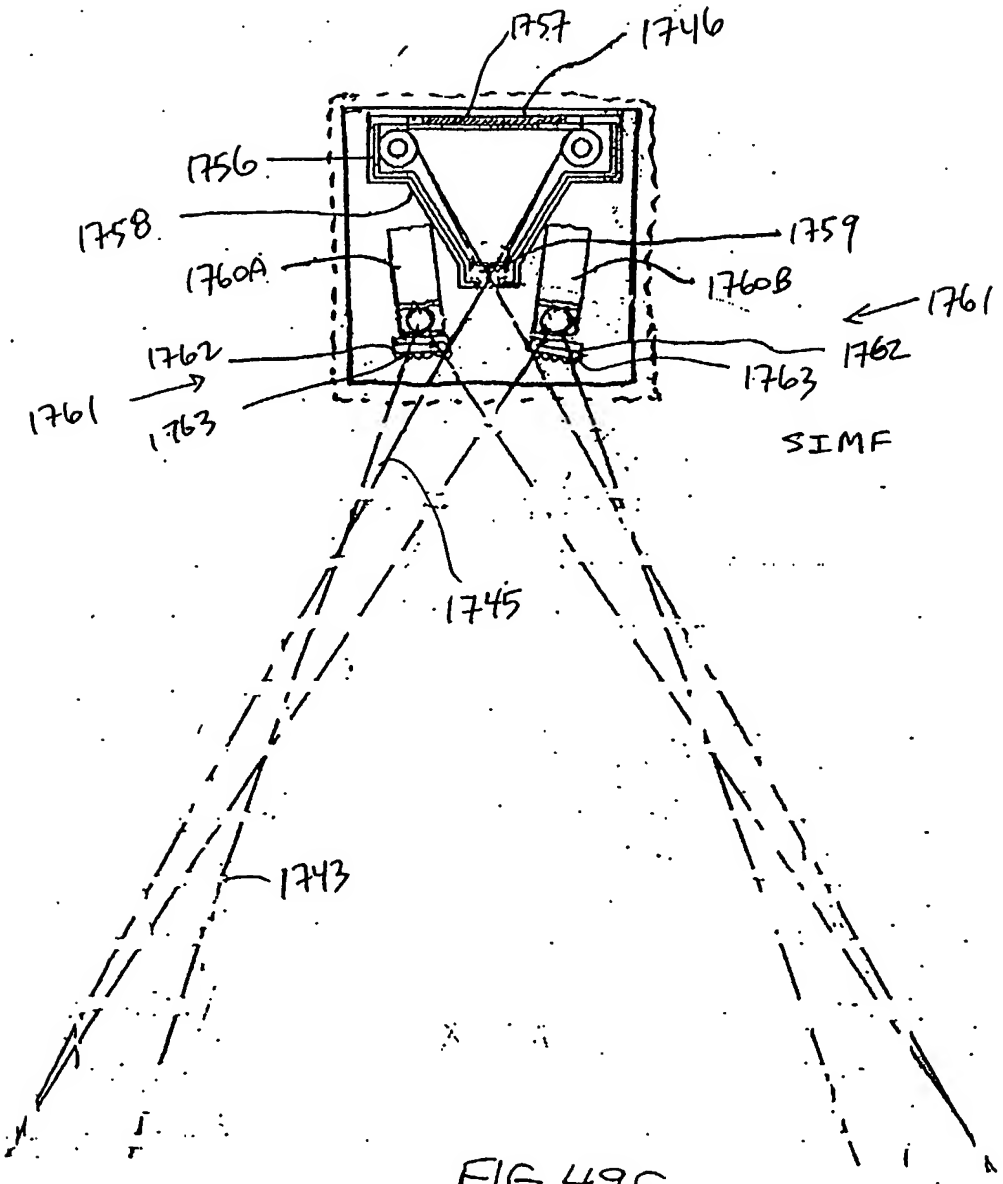
1757
1746
1756
1758
1759
1760A
1760B
1761
1762
1762
1761
1763
1763
SIMF
1745
1743

FIG. 49C

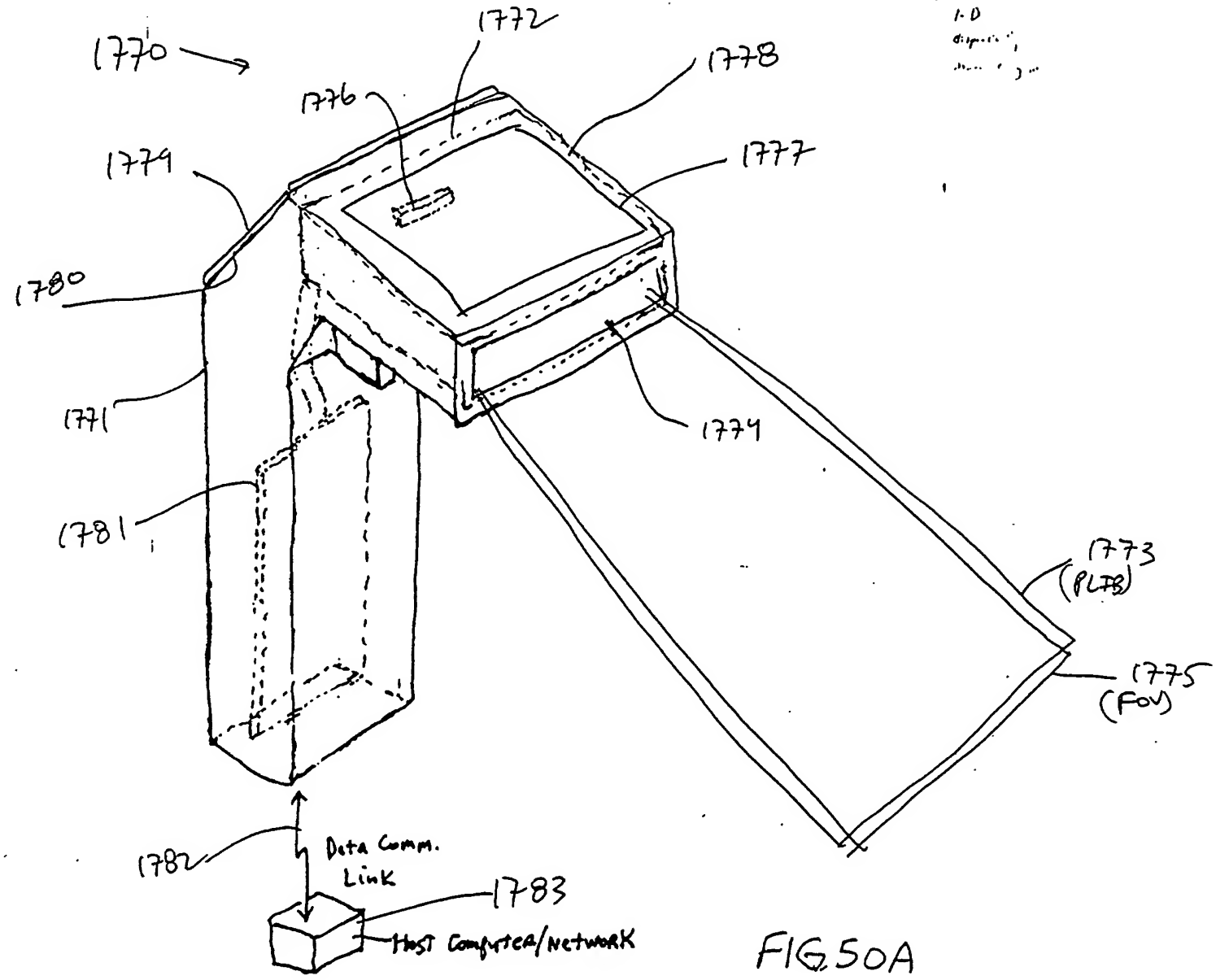

FIG 50A

WO 2022/060673 PCT/US2021/050948

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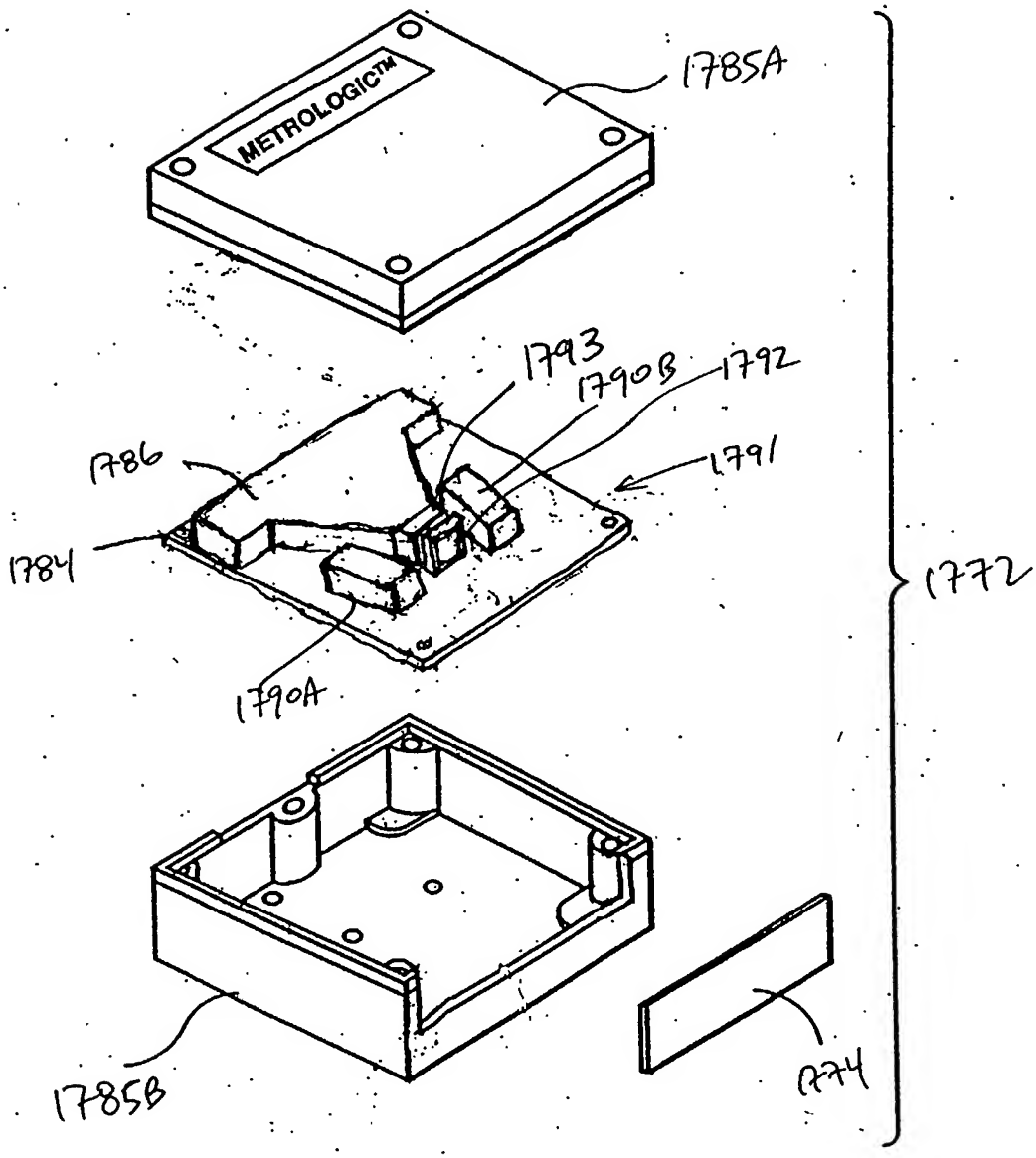

FIG. 50B

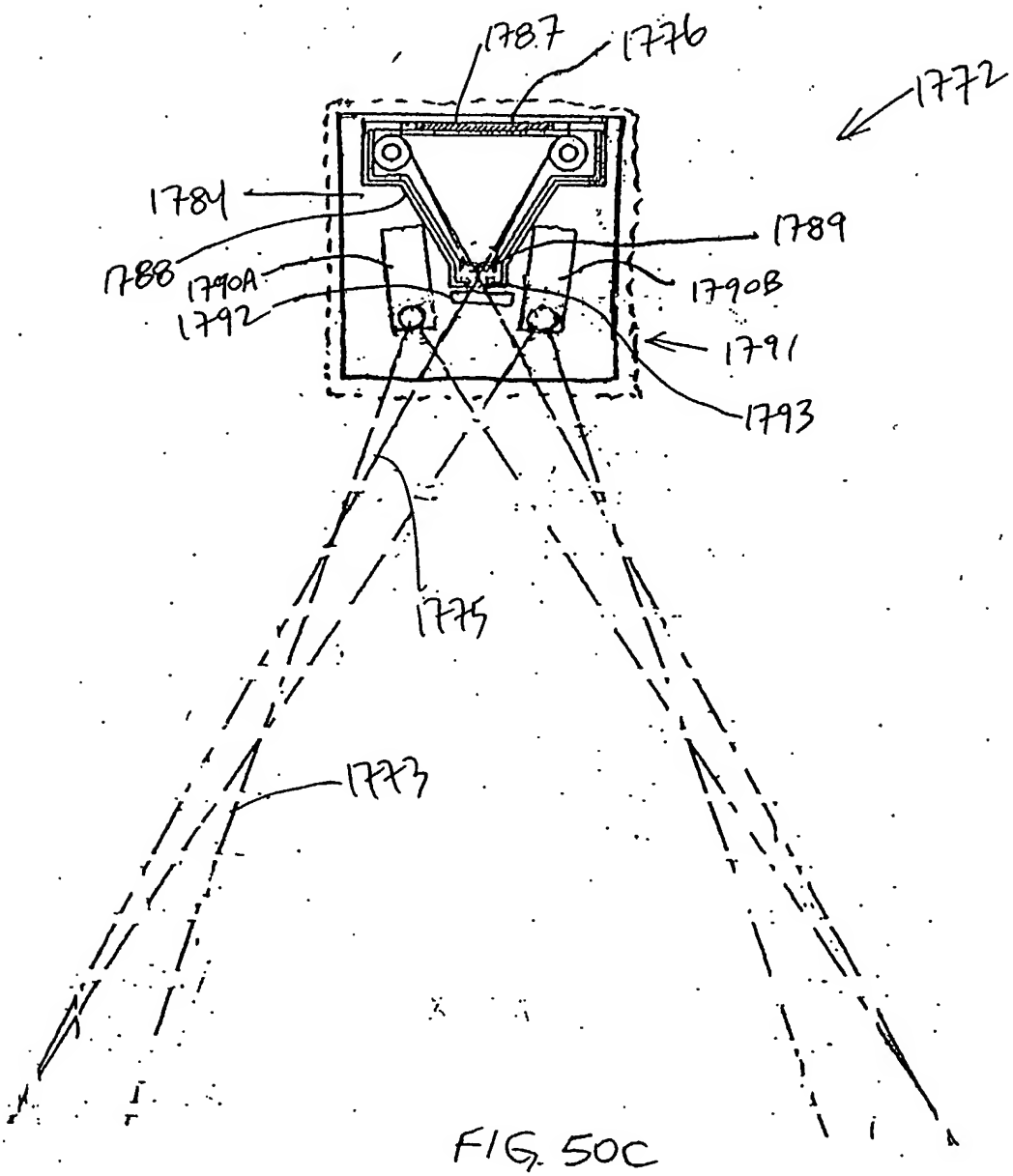
1787
1776
1772
1784
1789
1788
1790A
1790B
1792
1791
1793
1775
1773

FIG. 50C

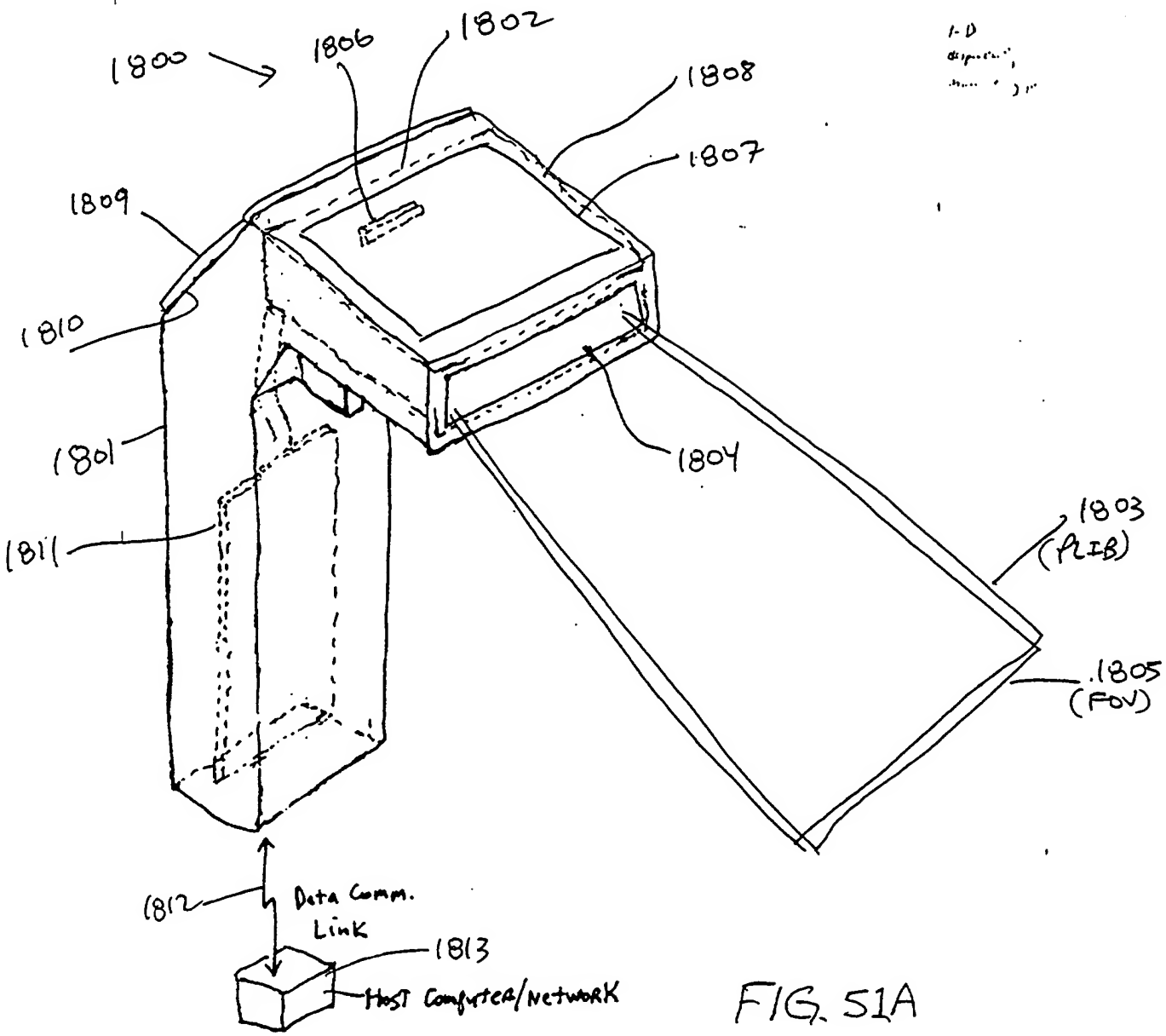

FIG. 51A

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20020126076

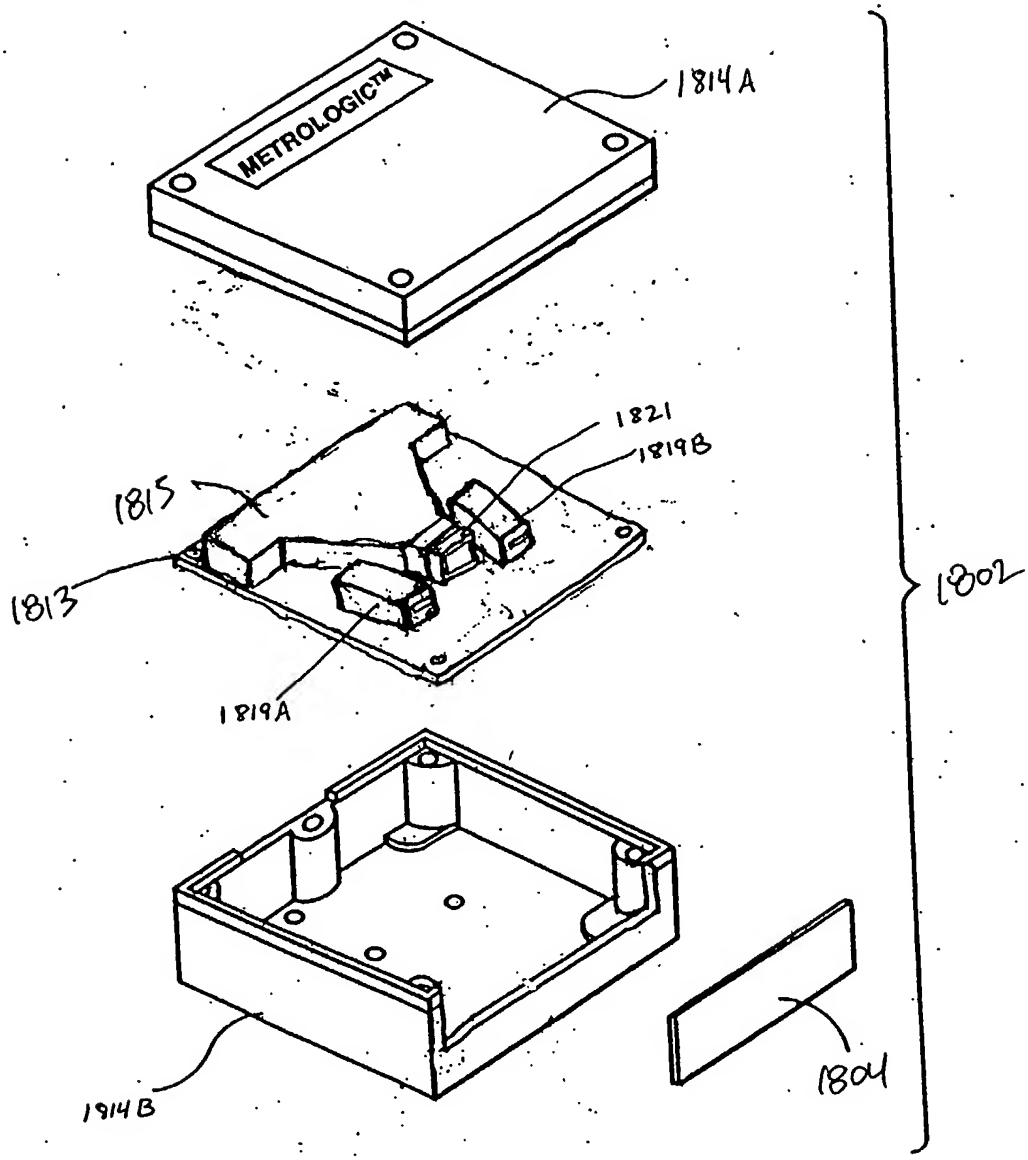
METROLOGIC™
1814A
1821
1819B
1815
1813
1819A
1802
1914B
1804

FIG. 51B

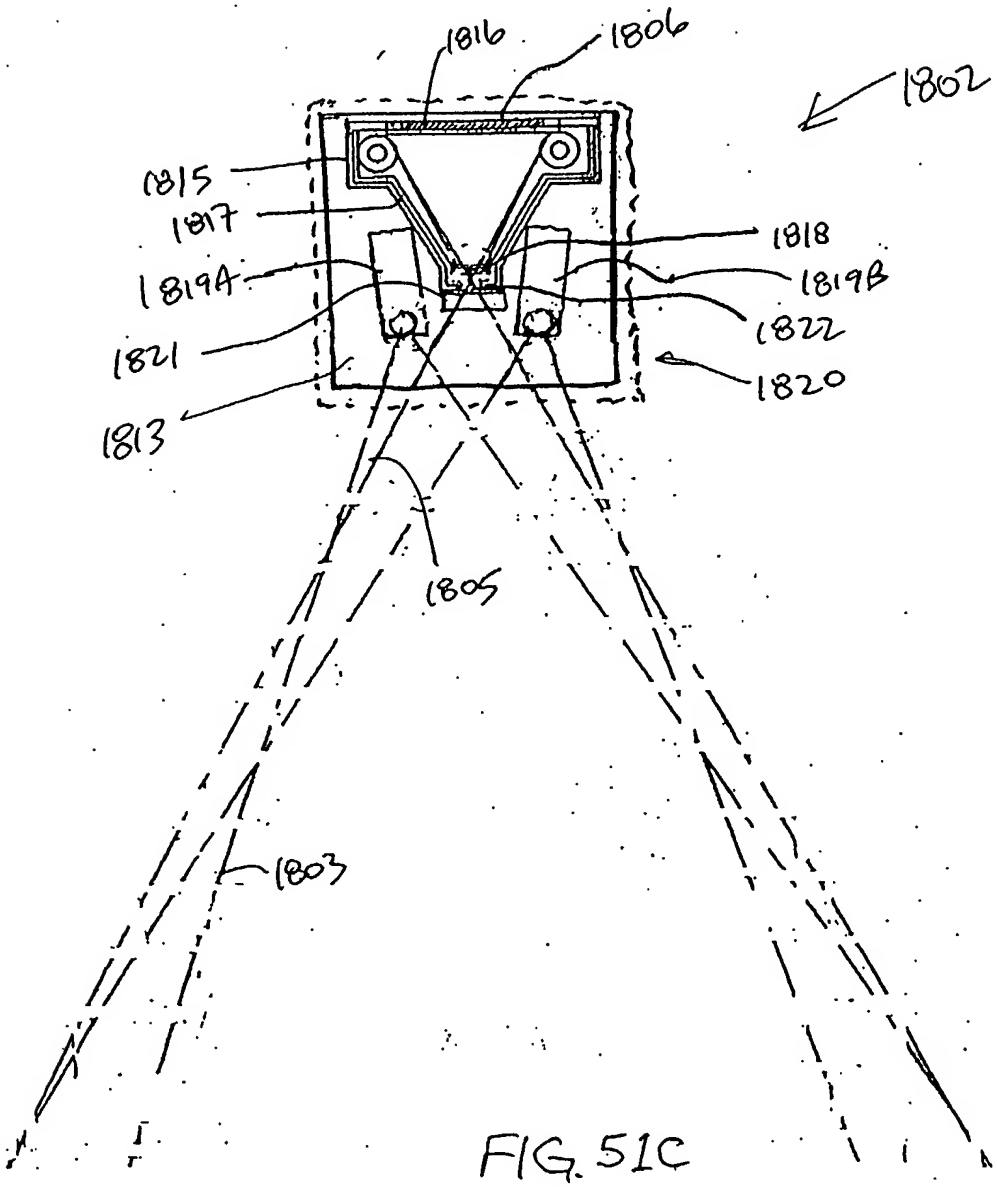
1816
1806
1802
1815
1817
1818
1819A
1819B
1821
1822
1820
1813
1805
1803

FIG. 51C

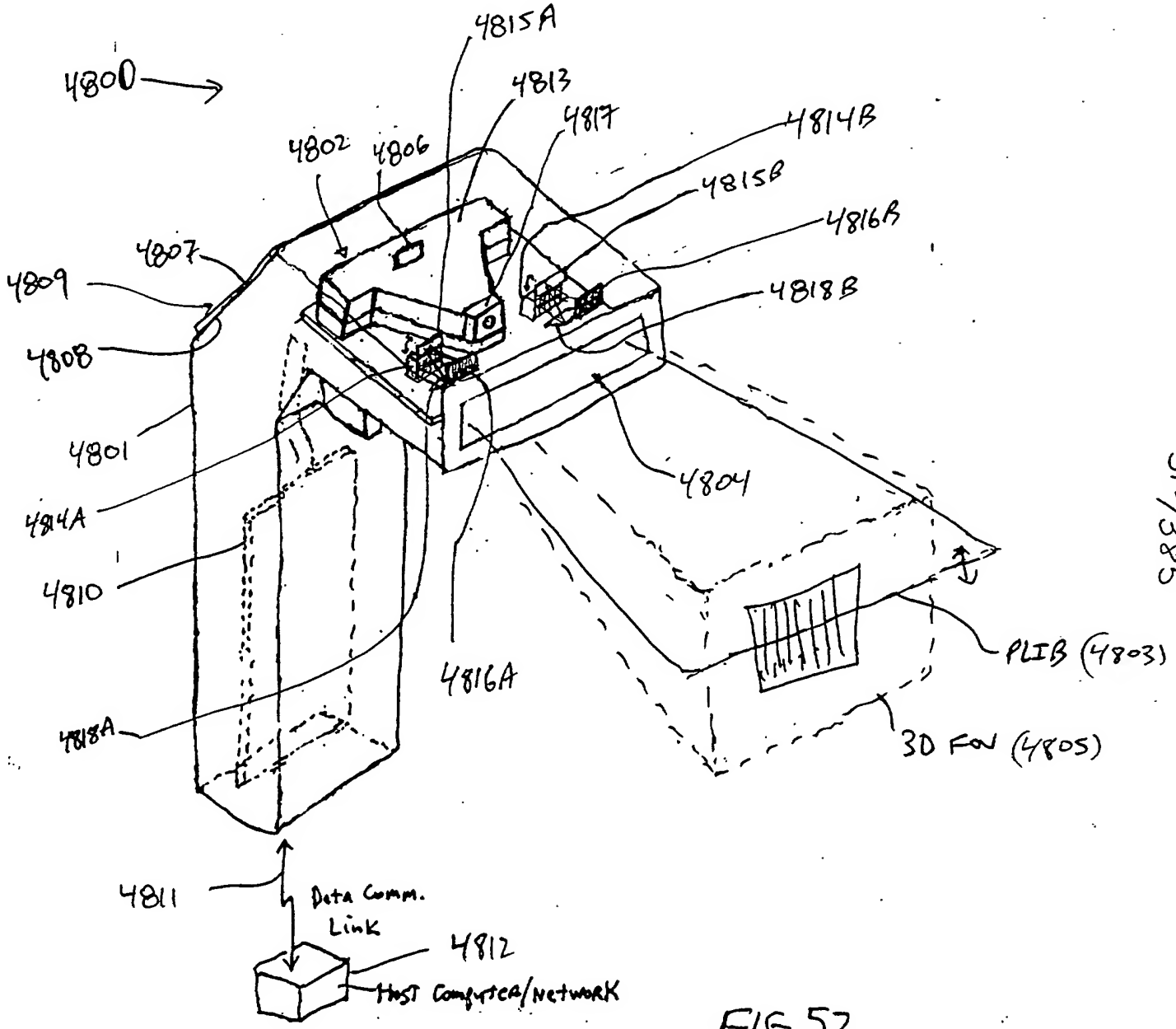

FIG. 52

20040227.2250 / 22884.8007

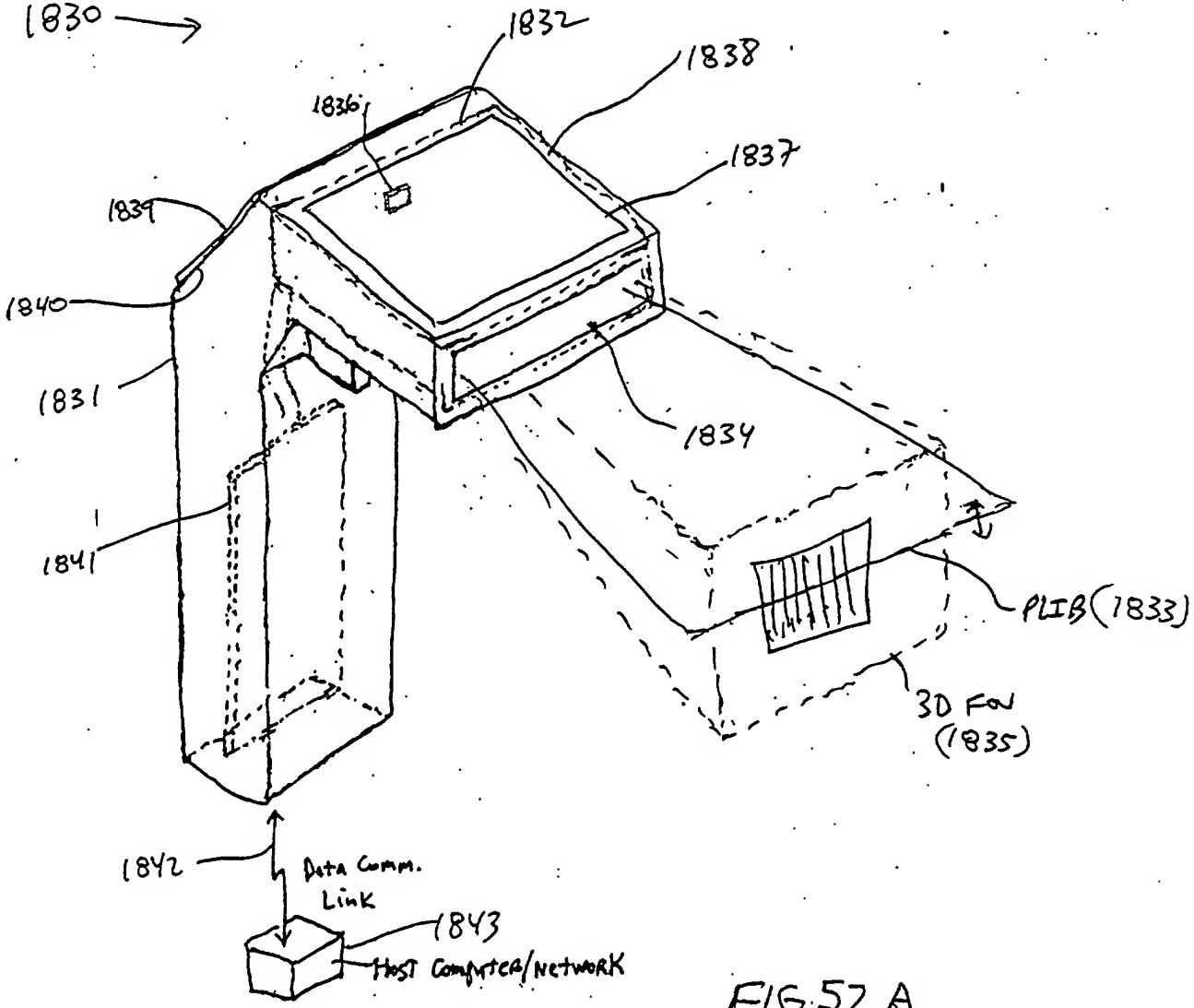

FIG. 52A

20020158897

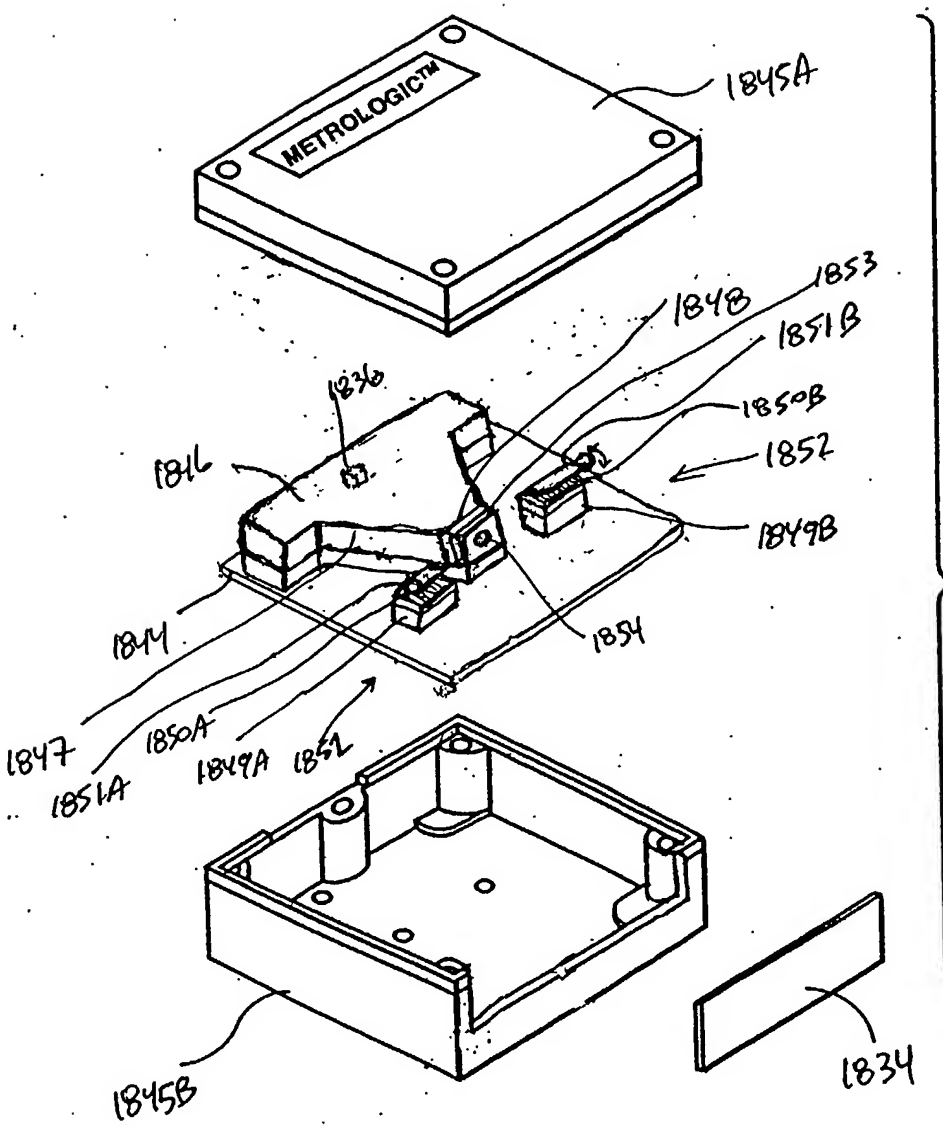

FIG. 52B

Fig. 113A-3B

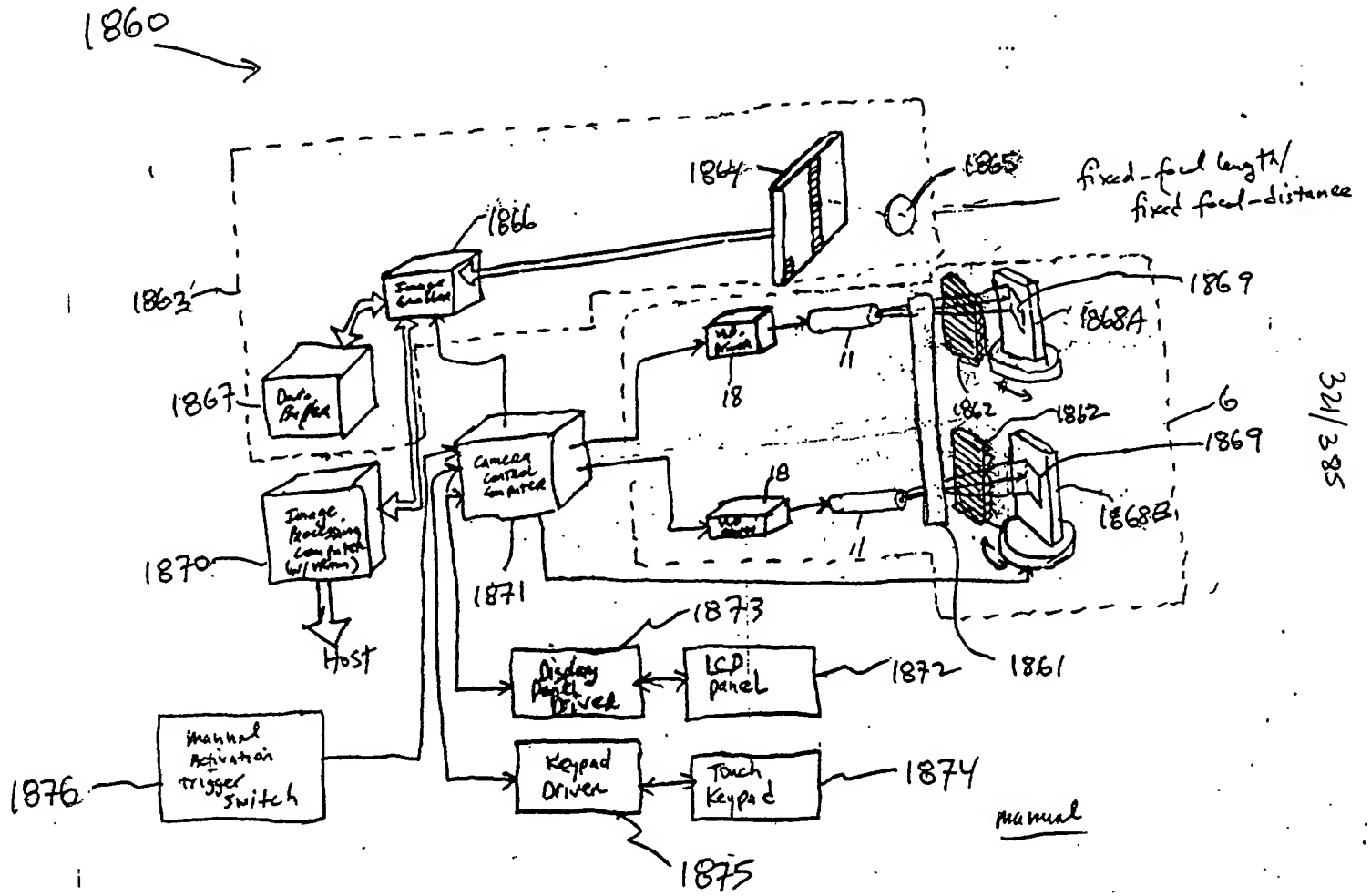

FIG. 53A1

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manual

20070228107

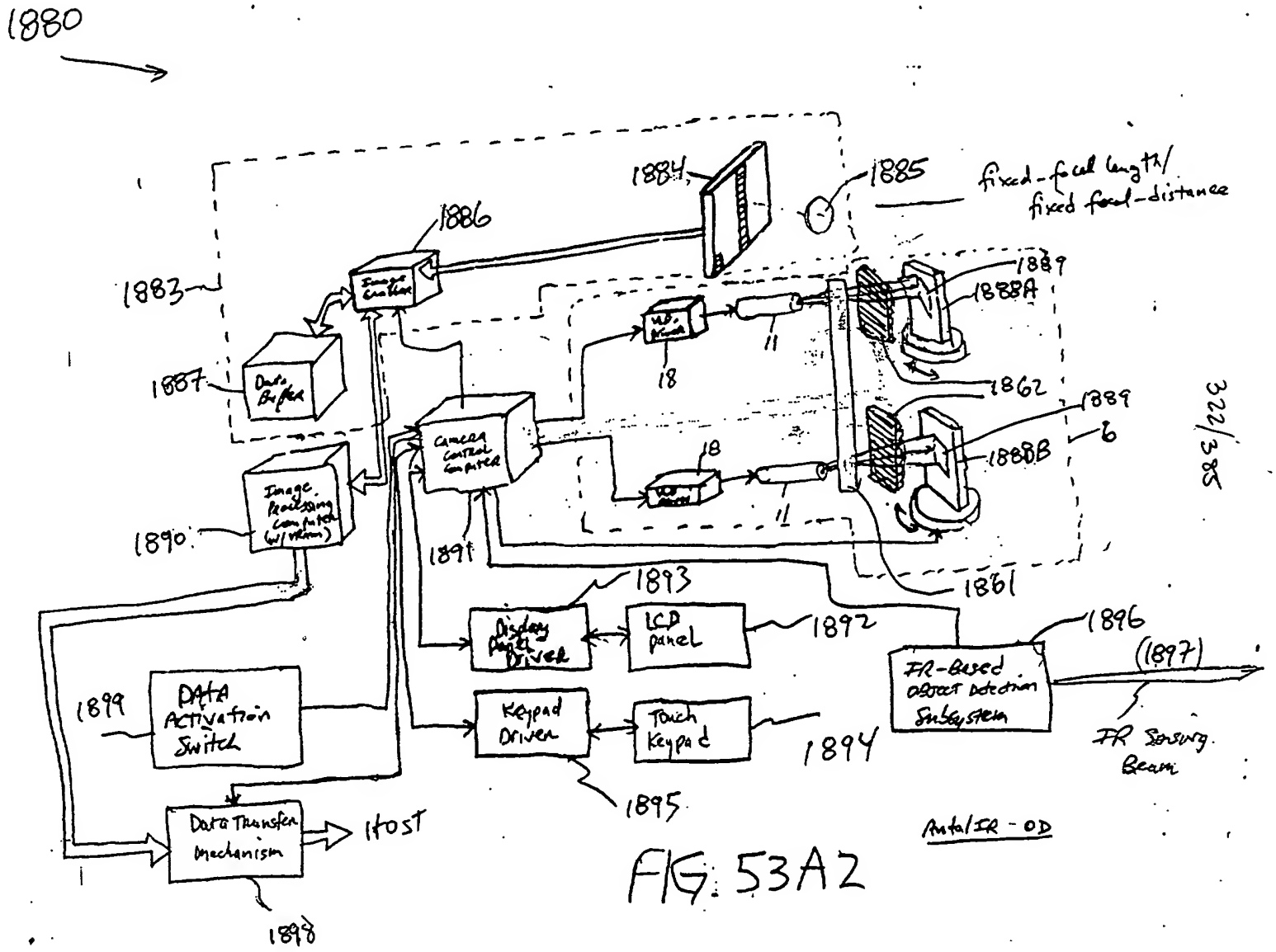

FIG. 53A2

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US 7,225,980 B2

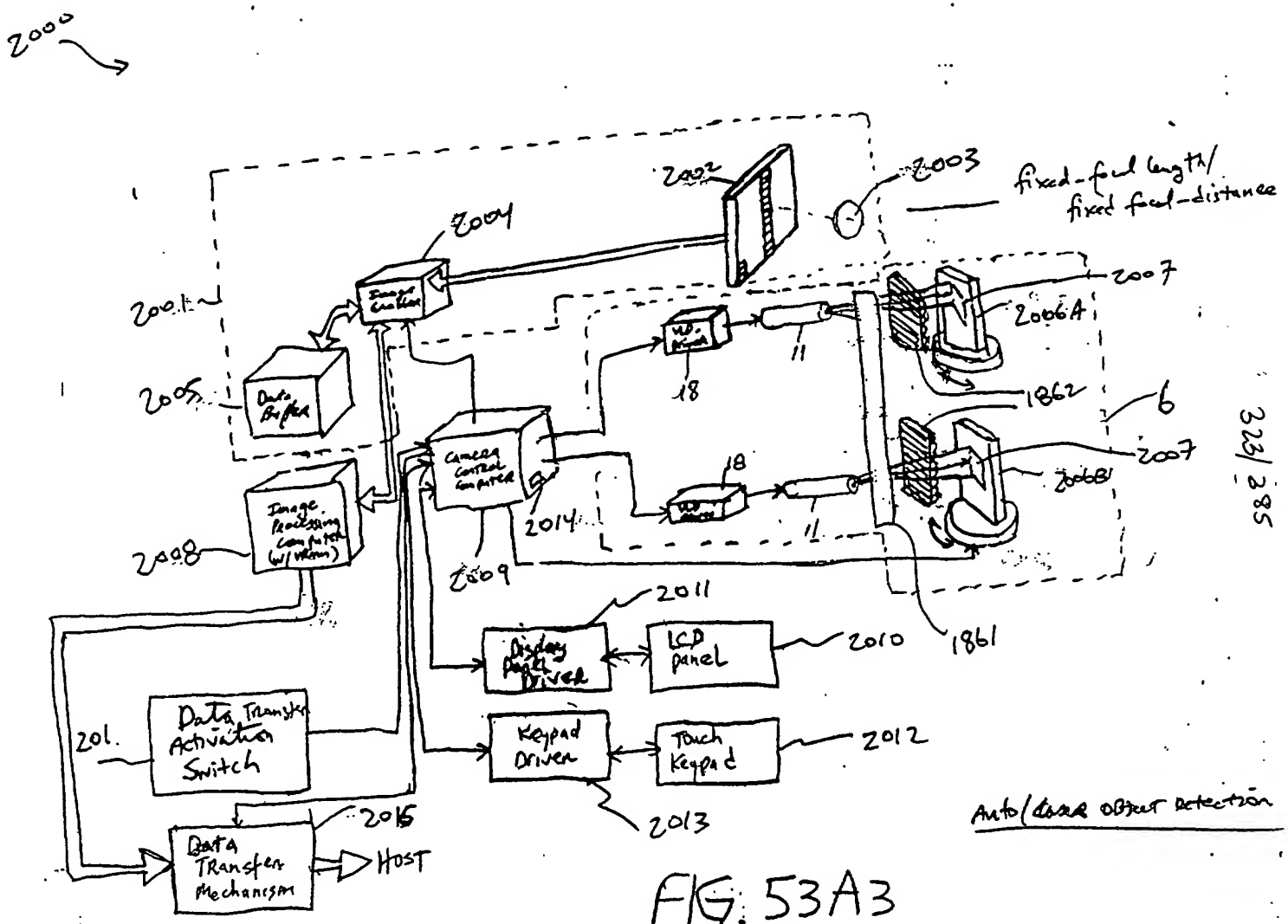

FIG. 53A3

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2002-02-20 "Version 7.0"

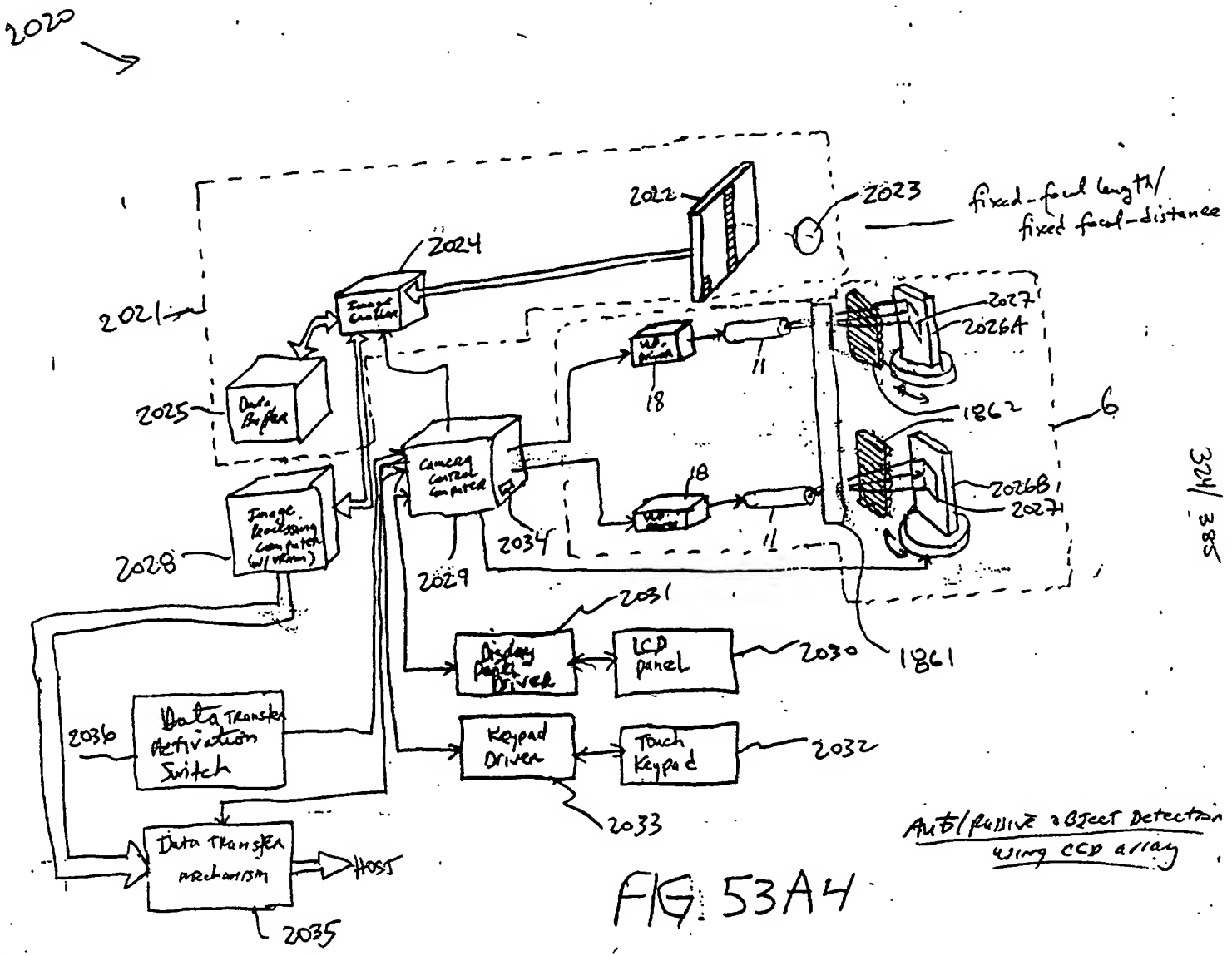

FIG. 53A4

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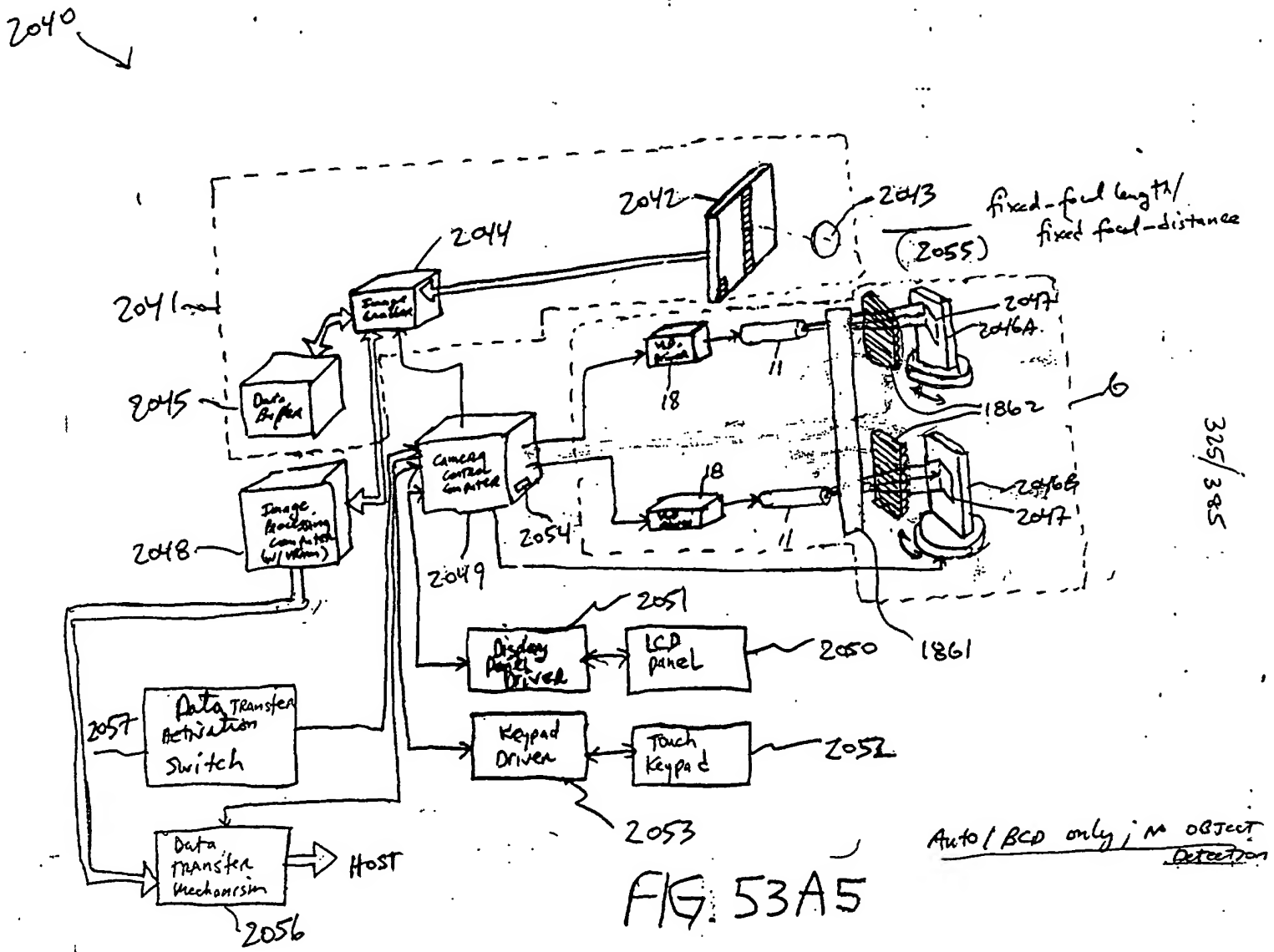
20020148655


2040
2042
2043
fixed-focal length/
fixed focal-distance
(2055)
2044
2041
2045
2047
2046A
18
1862
6
2046B
2047
2054
2049
2048
2051
LCD panel
2050
1861
2057
Data Transfer Activation Switch
Keypad Driver
Touch Keypad
2052
2053
Data Transfer Mechanism
HOST
2056
Auto/BCD only; no object detection
FIG. 53A5
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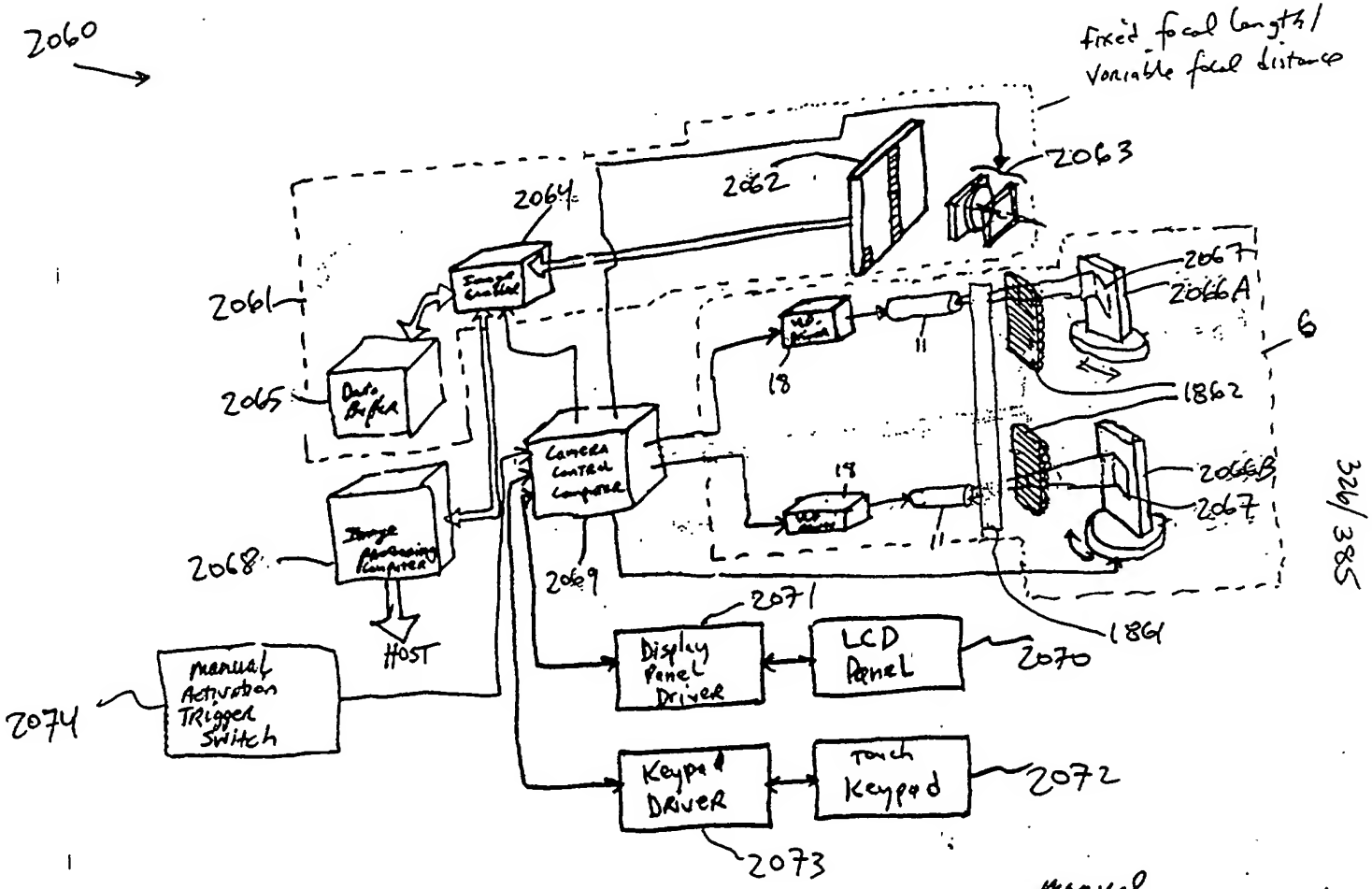
2060
fixed focal length/
variable focal distance
2063
2062
2064
2061
2067
2066A
6
2065
18
1862
2066B
2067
326/385
2068
2069
2071
1861
HOST
Display Panel Driver
LCD Panel
2070
manual Activation Trigger Switch
2074
Keypad DRIVER
Touch Keypad
2072
2073
manual

FIG. 53B1

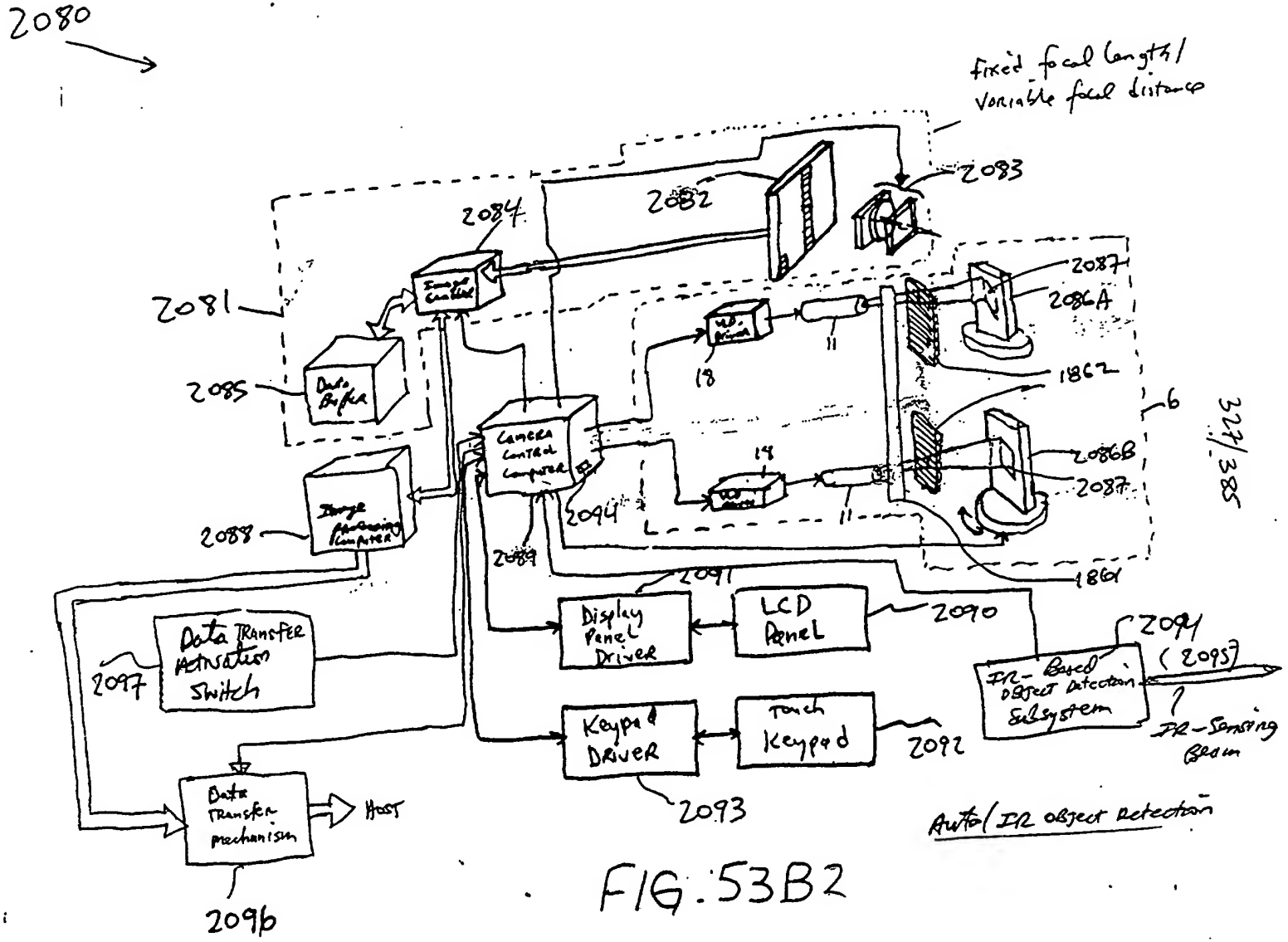
2080
fixed focal length/
variable focal distance
2083
2082
2084
2081
2087
2086A
2085
18
18C2
6
327/385
Camera Control Computer
2086B
2087
19
2094
2088
2089
18C1
2091
Display Panel Driver
LCD Panel
2090
2097
Data Transfer Activation Switch
2091
(2095)
IR-Based Object Detection Subsystem
IR-Sensing Beam
Keypad Driver
Touch Keypad
2092
Data Transfer mechanism
Host
2093
Auto/IR object detection
2096

FIG. 53B2

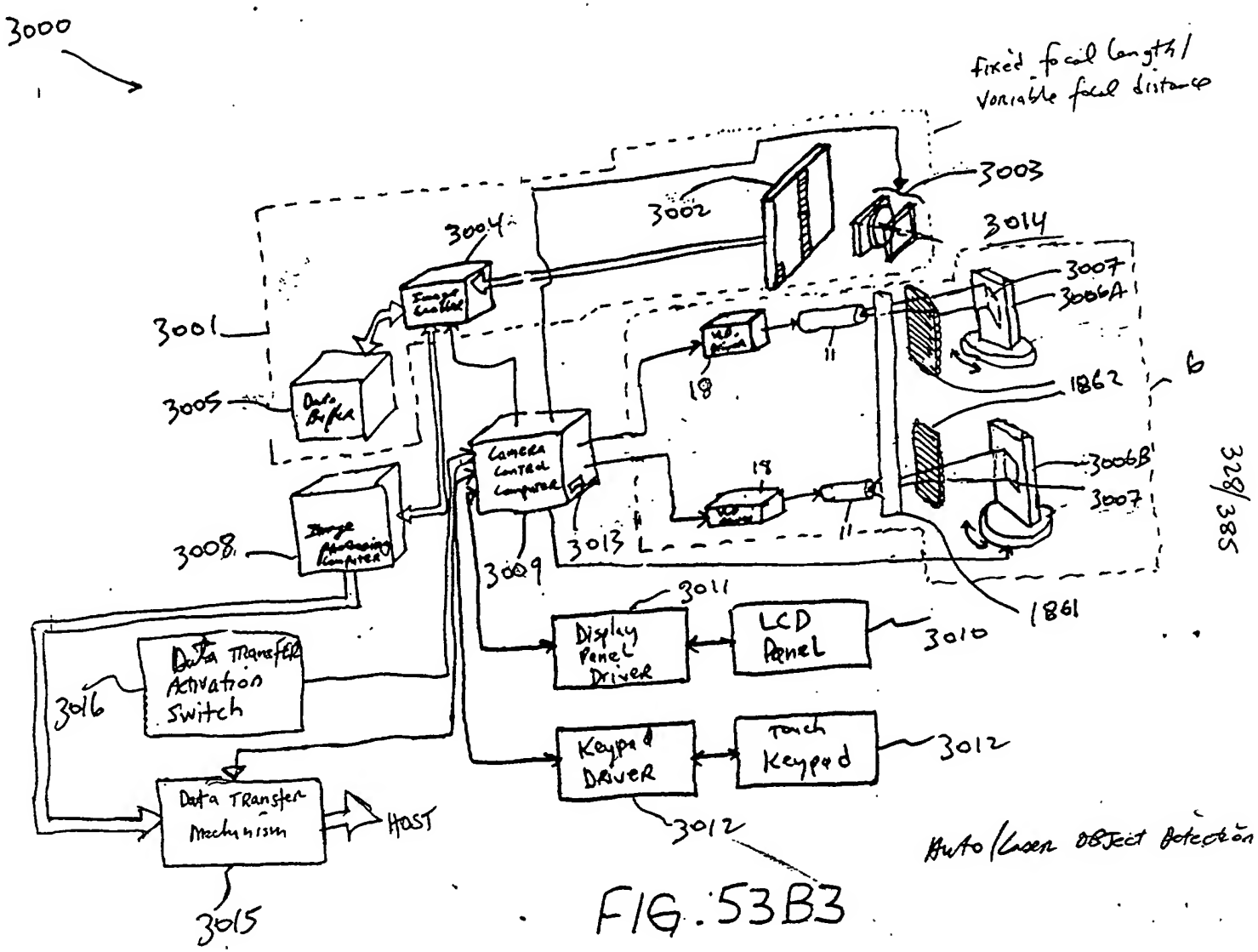

FIG. 53B3

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20020220.2284.8008E

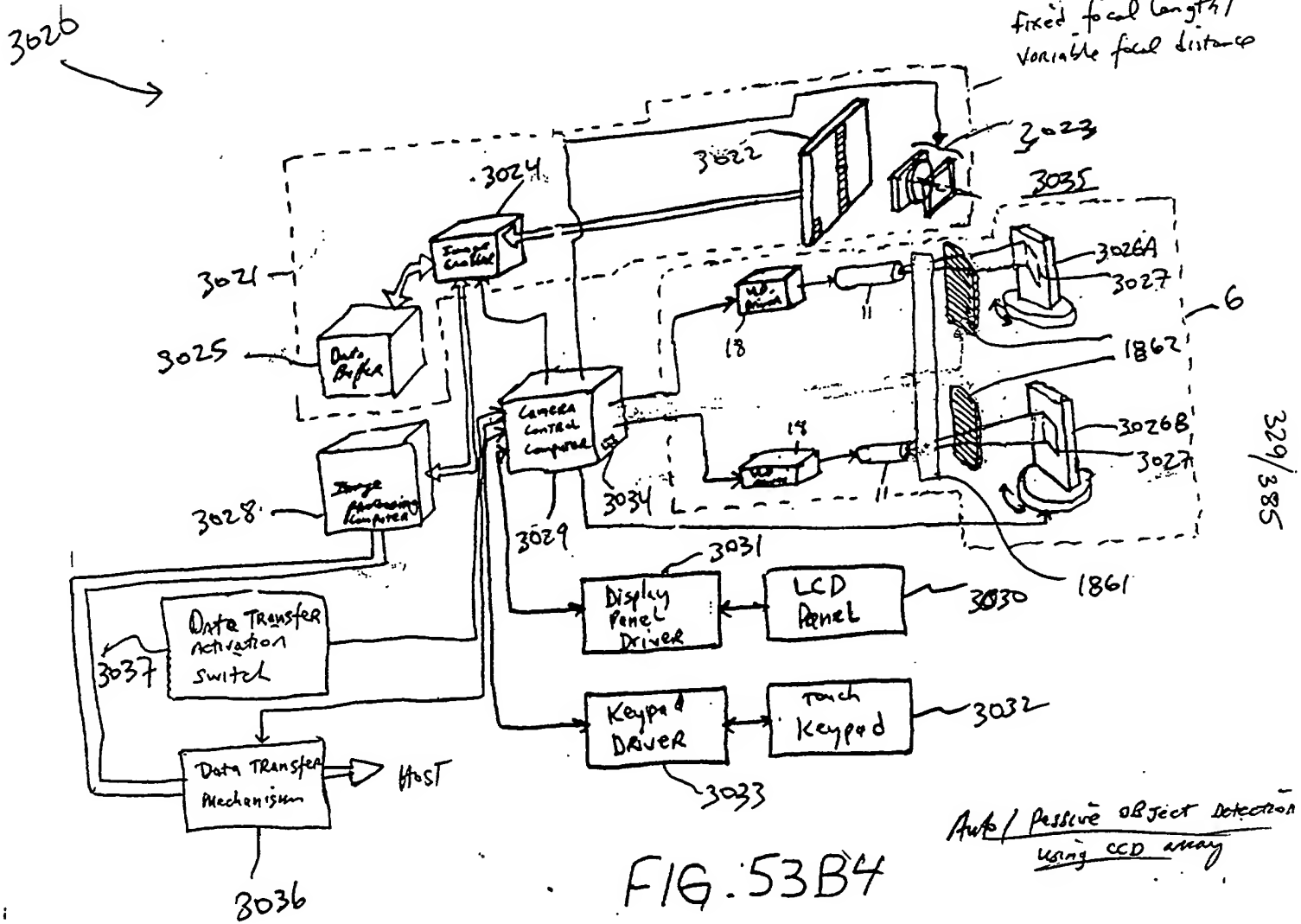

FIG. 53B4

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20020220-2884800.1

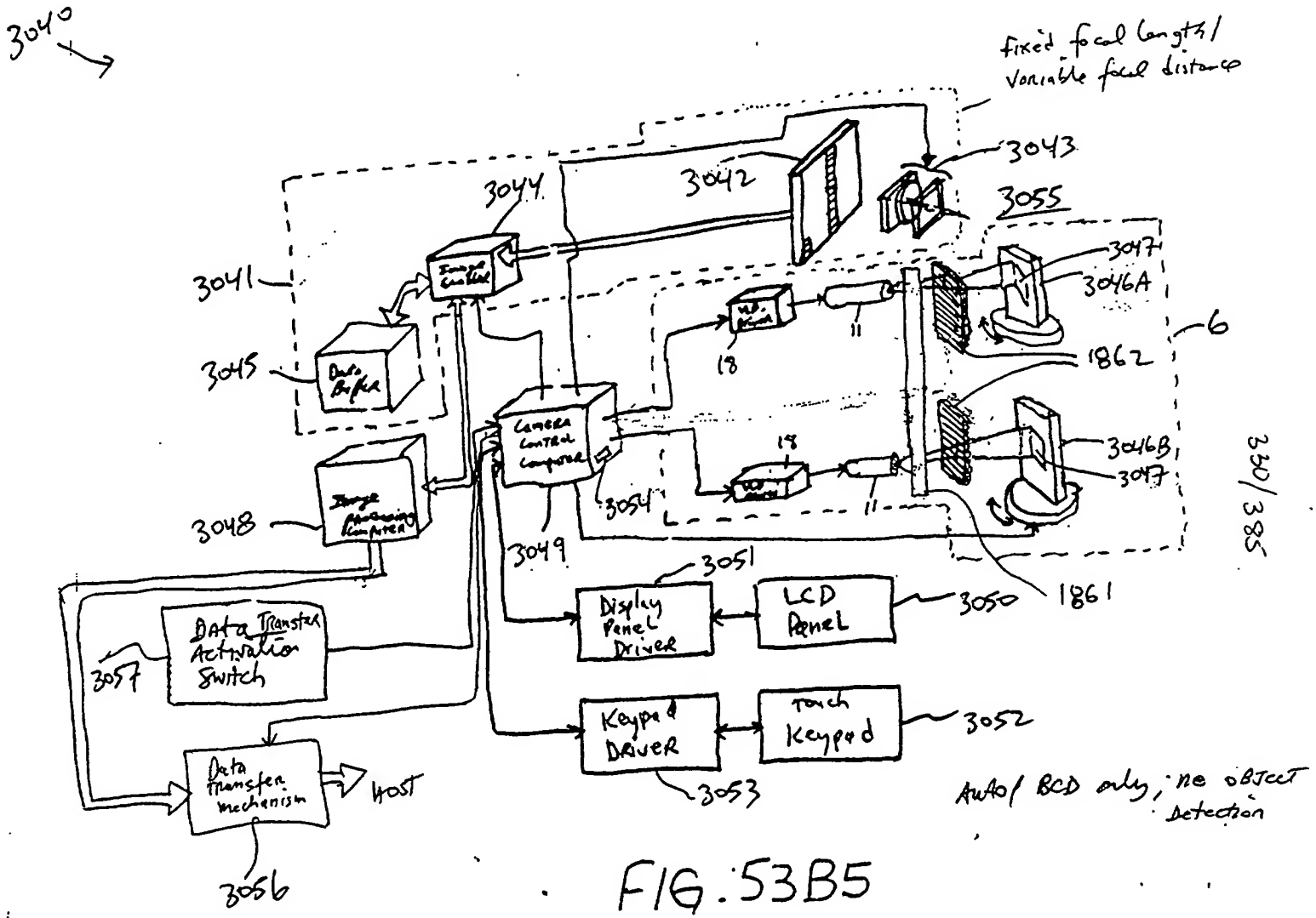
3040
fixed focal length/
variable focal distance
3043
3042
3044
3055
3041
3047
3046A
6
3045
18
1862
Camera Control Computer
3046B
3047
3054
3048
3049
3051
1861
Display Panel Driver
LCD Panel
3050
Data Transfer Activation Switch
3057
Keypad Driver
Touch Keypad
3052
Data transfer mechanism
HOST
3053
3056
Auto/ BCD only; no object detection
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FIG. 53B5

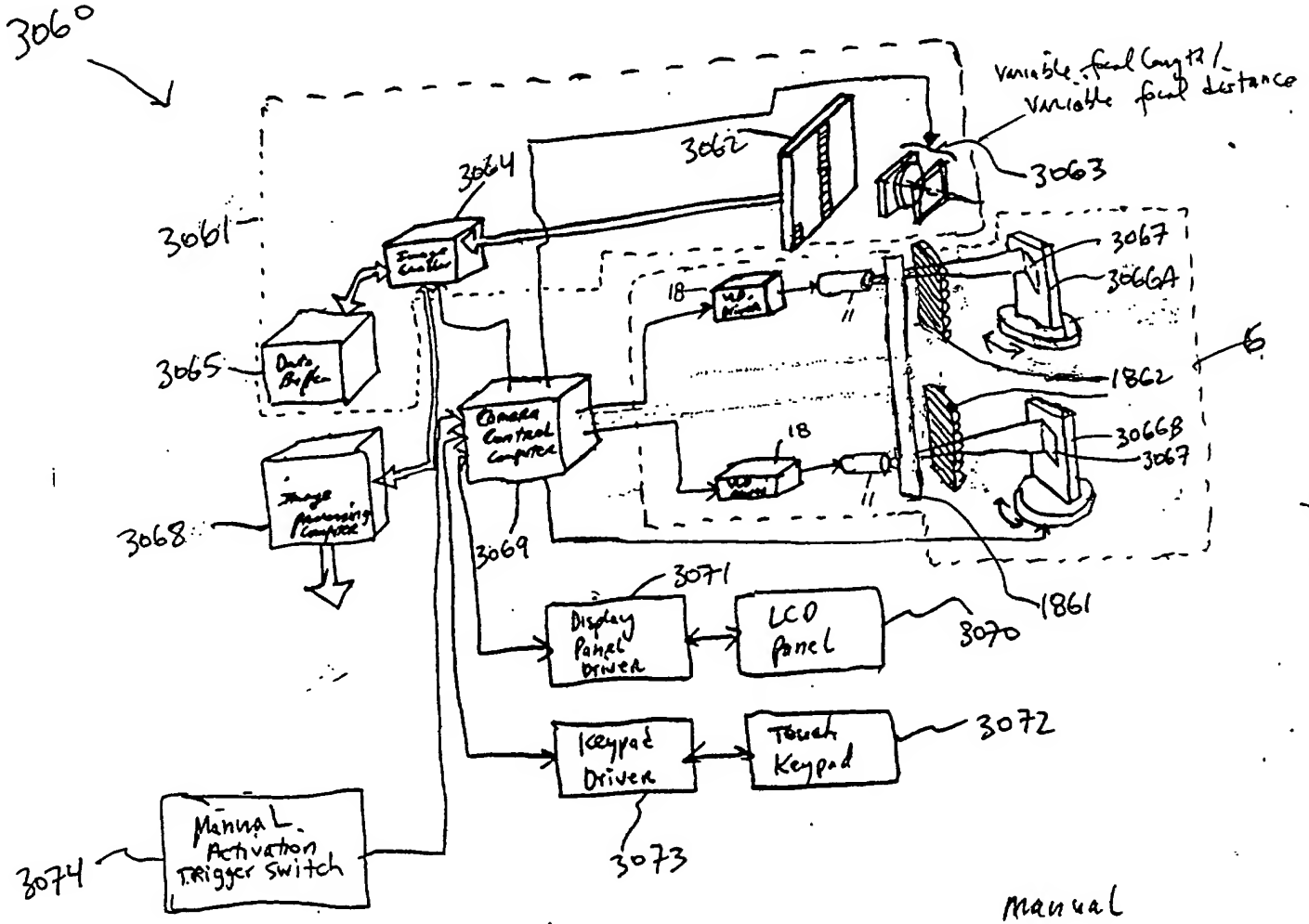

FIG. 53C1

20070220.P2504D01

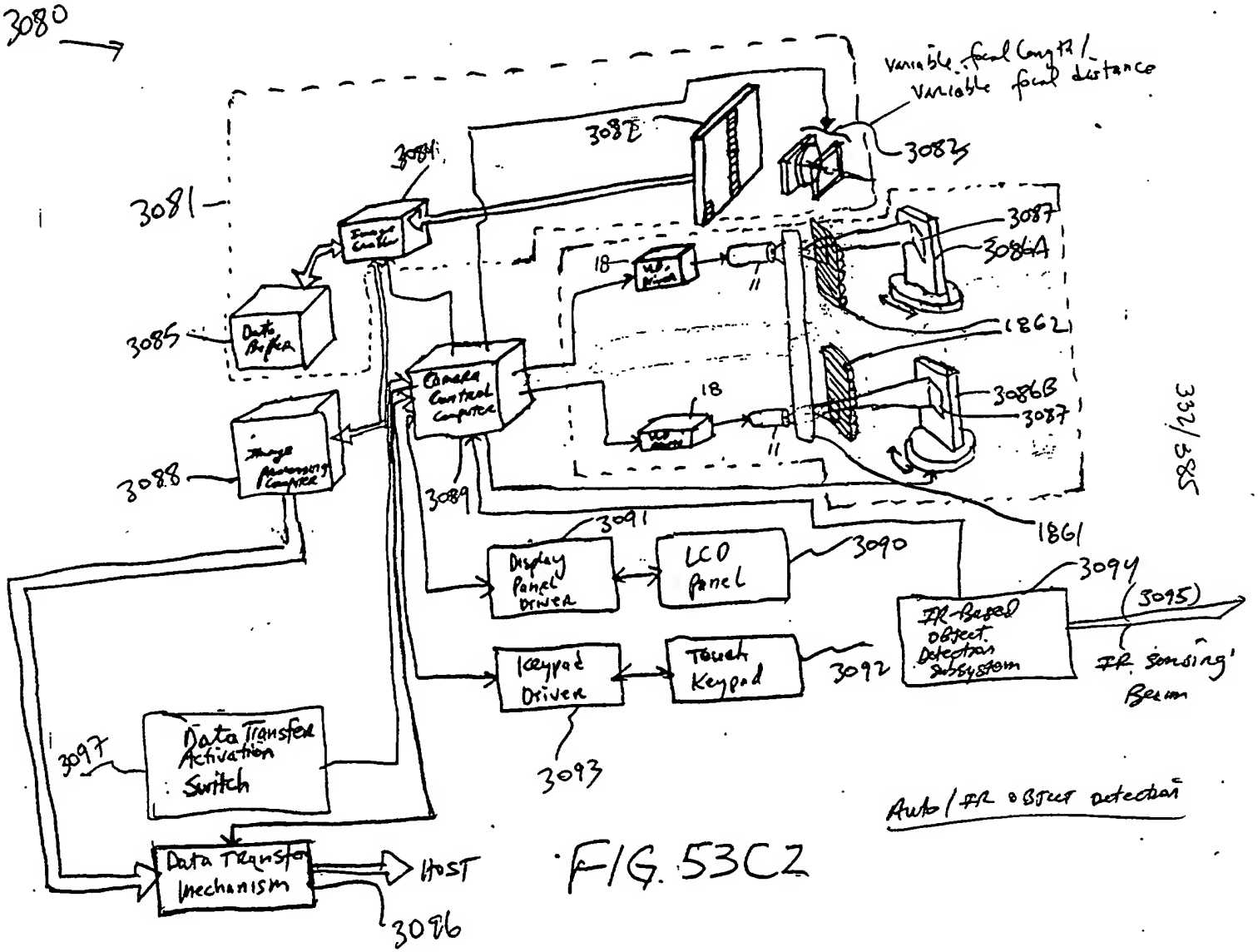
3080
3081
3082
3083
3084
3085
3086
3087
3088
3089
3090
3091
3092
3093
3094
3095
3096
3097
Variable focal length / Variable focal distance
Data Buffer
Camera Control Computer
Image Processing Computer
Display Panel Driver
LCD Panel
Keypad Driver
Touch Keypad
IR-Based Object Detection Subsystem
IR Sensing Beam
Data Transfer Activation Switch
Data Transfer Mechanism
HOST
18
1861
1862
332/385
Auto / IR Object detection

FIG. 53C2

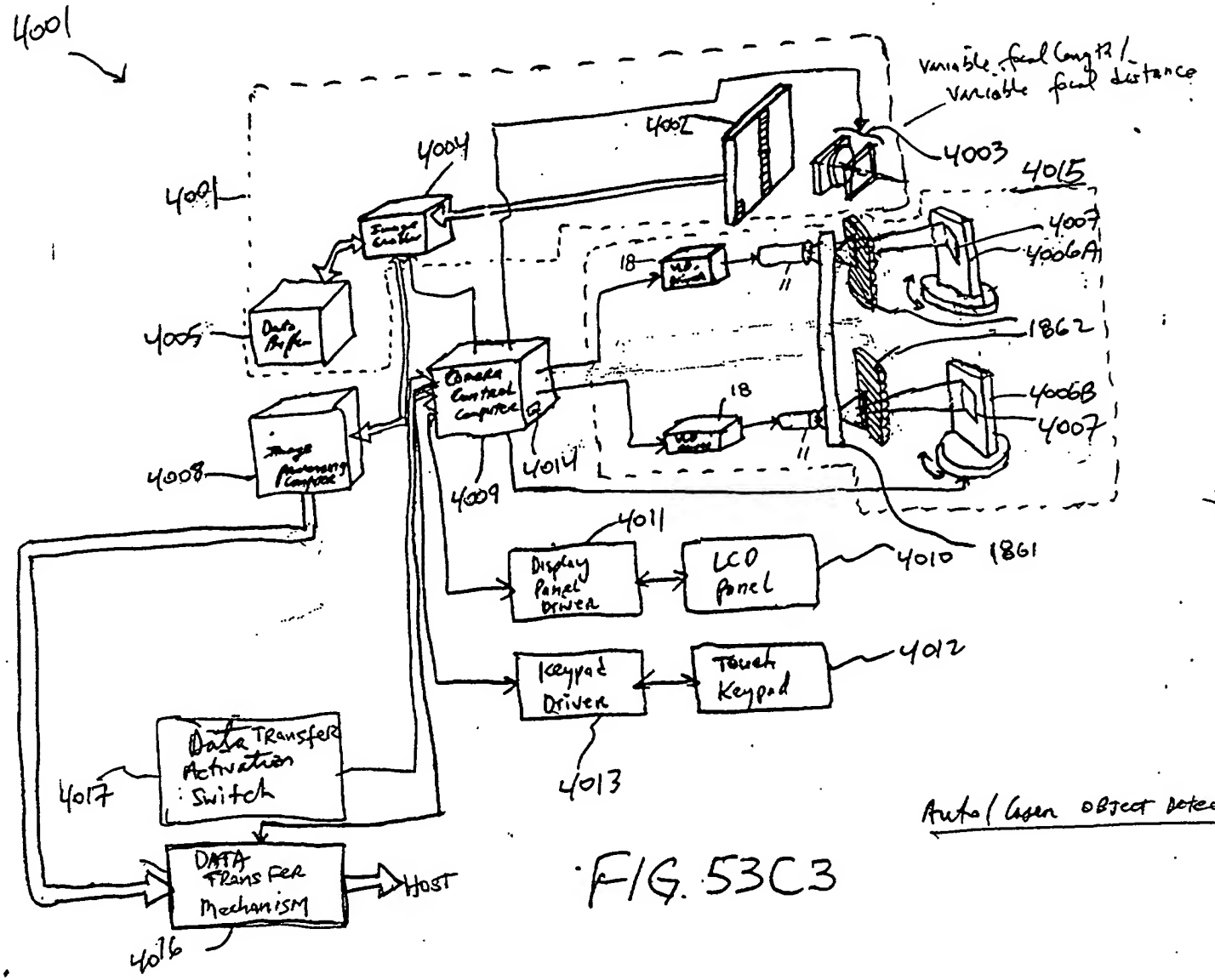

FIG. 53C3

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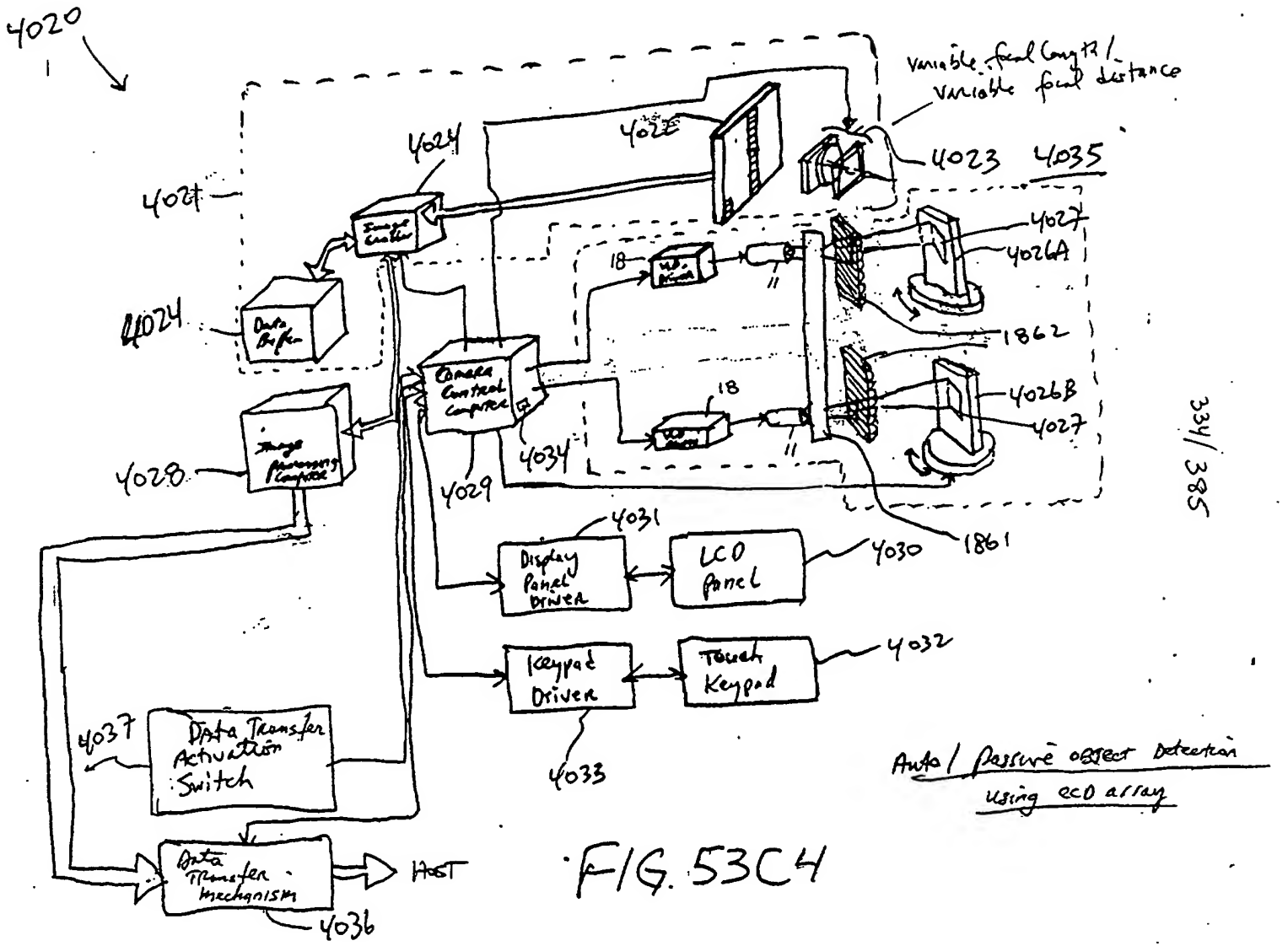

4020
Variable focal length / variable focal distance
4023
4035
4022
4024
4024
4024
4027
4026A
18
1862
4026B
4027
18
4034
4029
4028
4031
Display Panel Driver
LCD Panel
4030
1861
Keypad Driver
Touch Keypad
4032
4037
Data Transfer Activation Switch
4033
Data Transfer Mechanism
HOST
4036
Auto / passive object detection using ECD array

FIG. 53C4

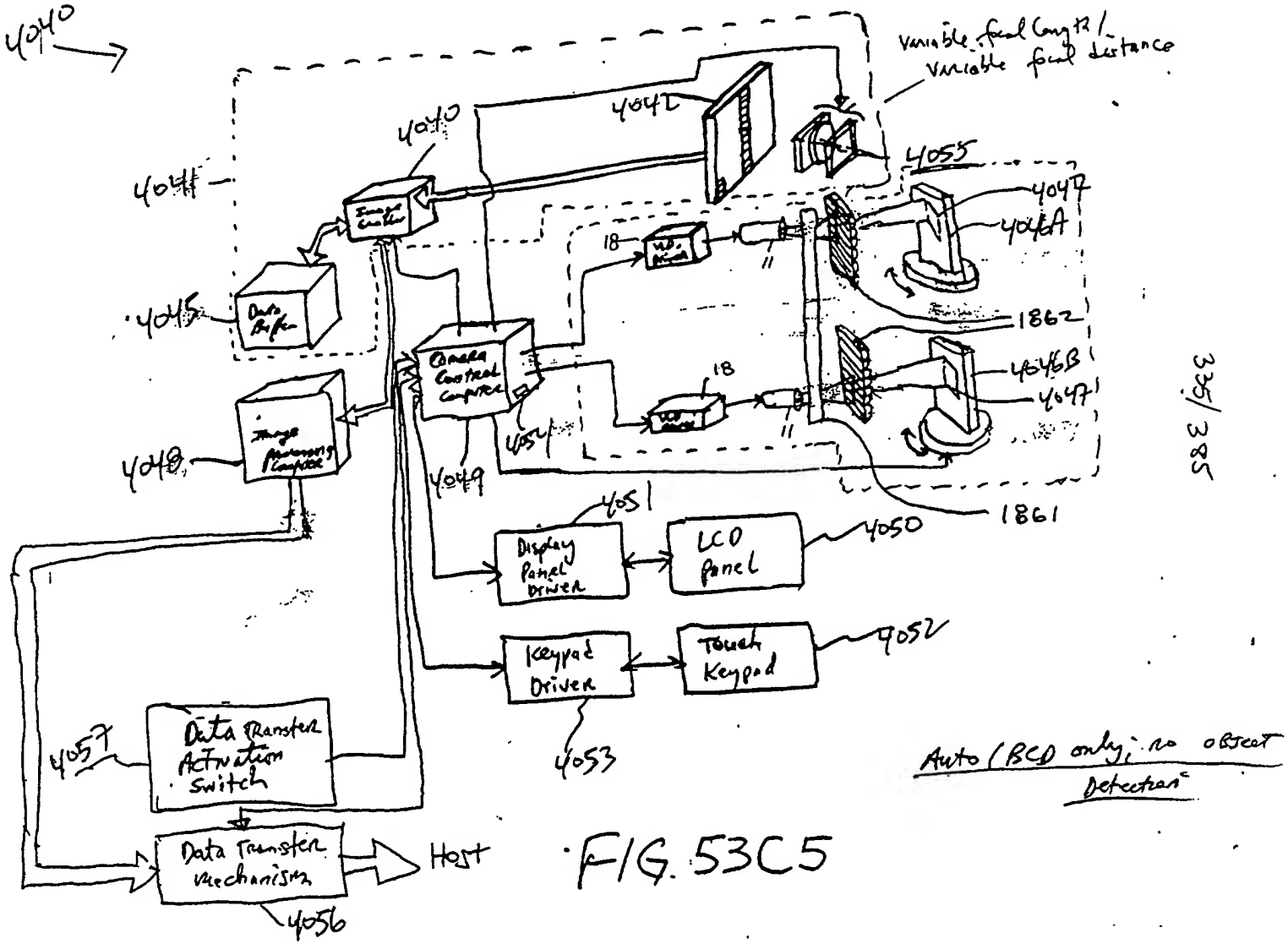


FIG. 53C5

US 2002/0060242 A1

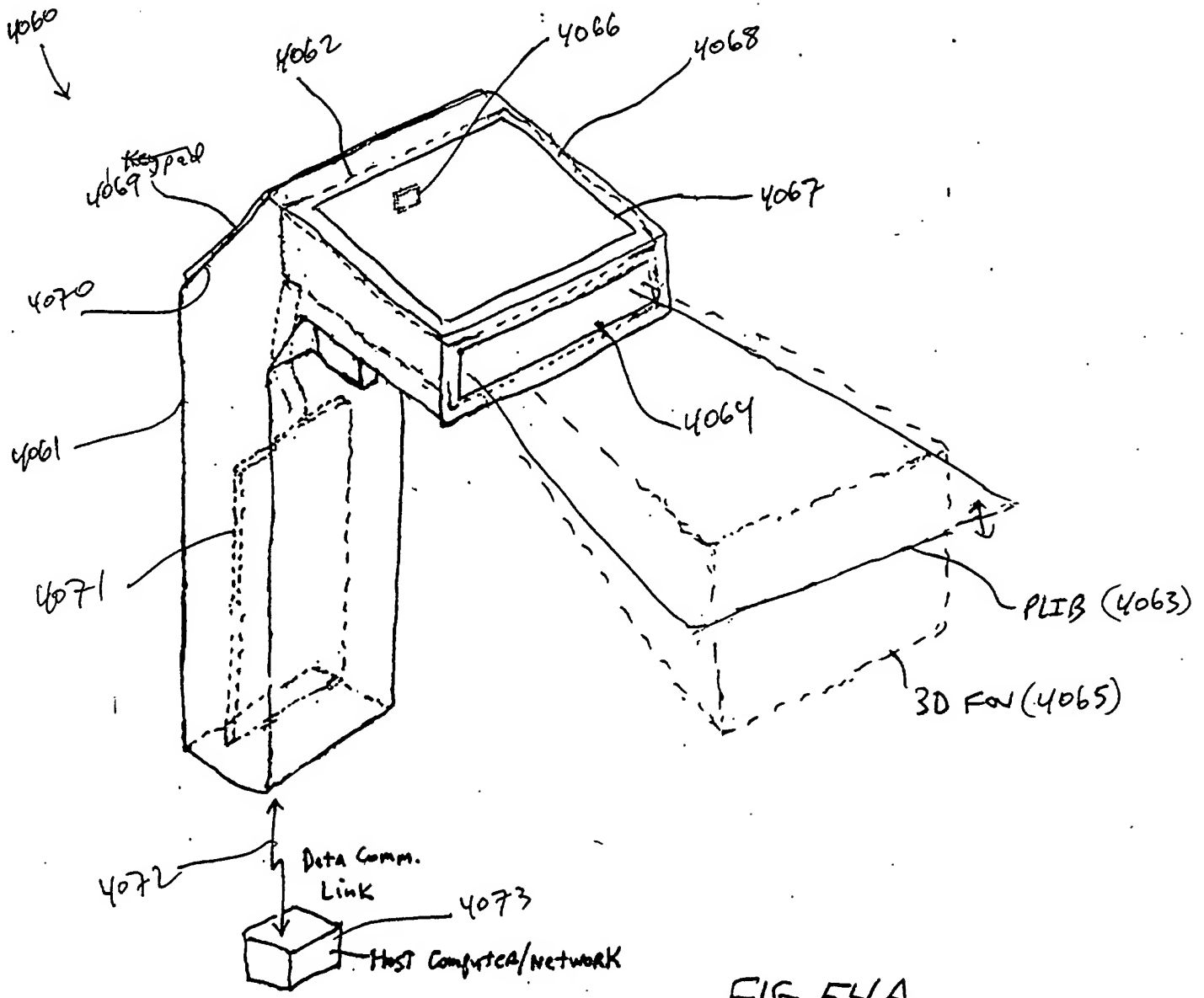
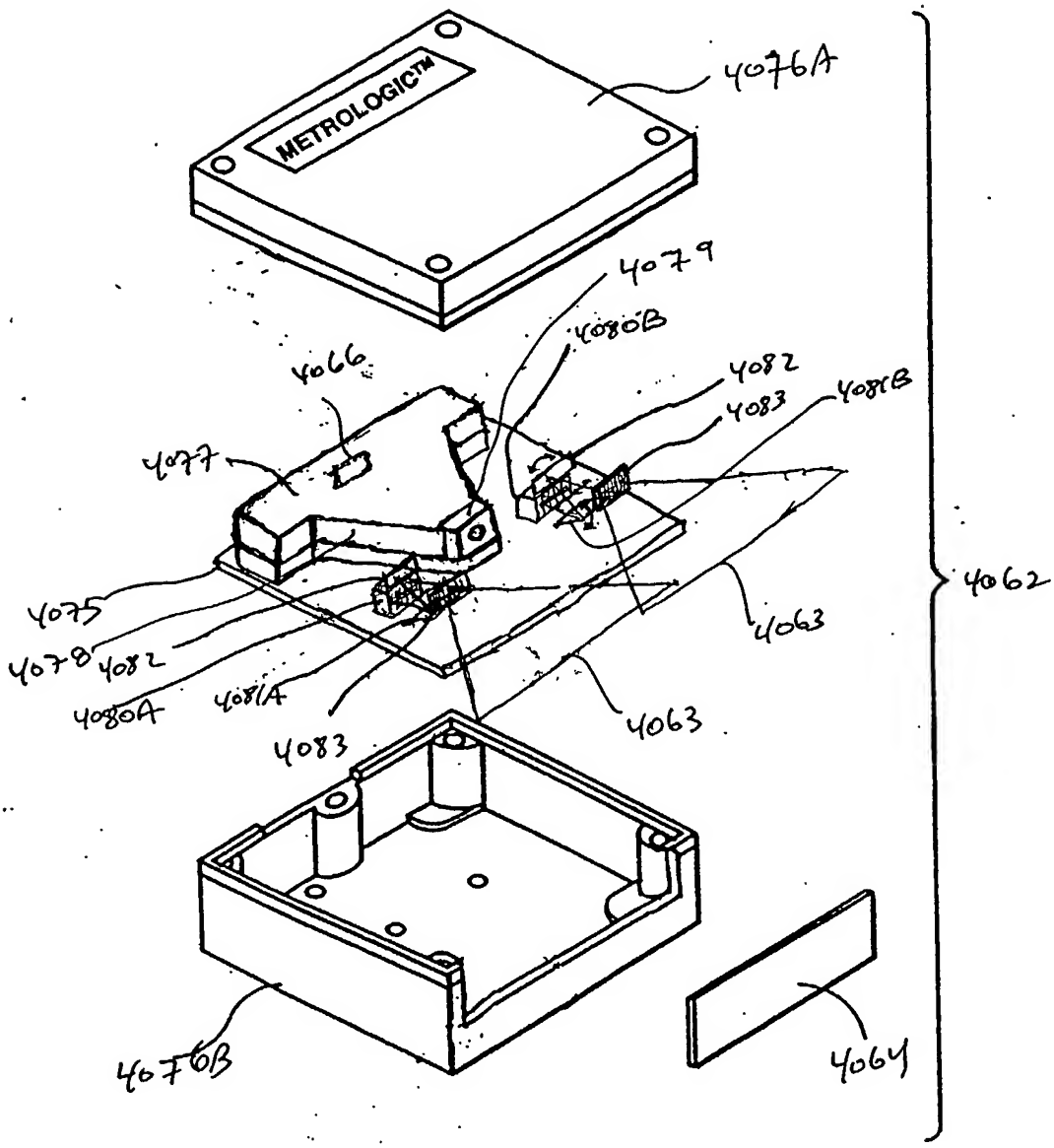


FIG. 54A

WO 2004/027685 PCT/US2003/029053



(dual mirrors)

FIG. 54B

Fig. IISA-5P1

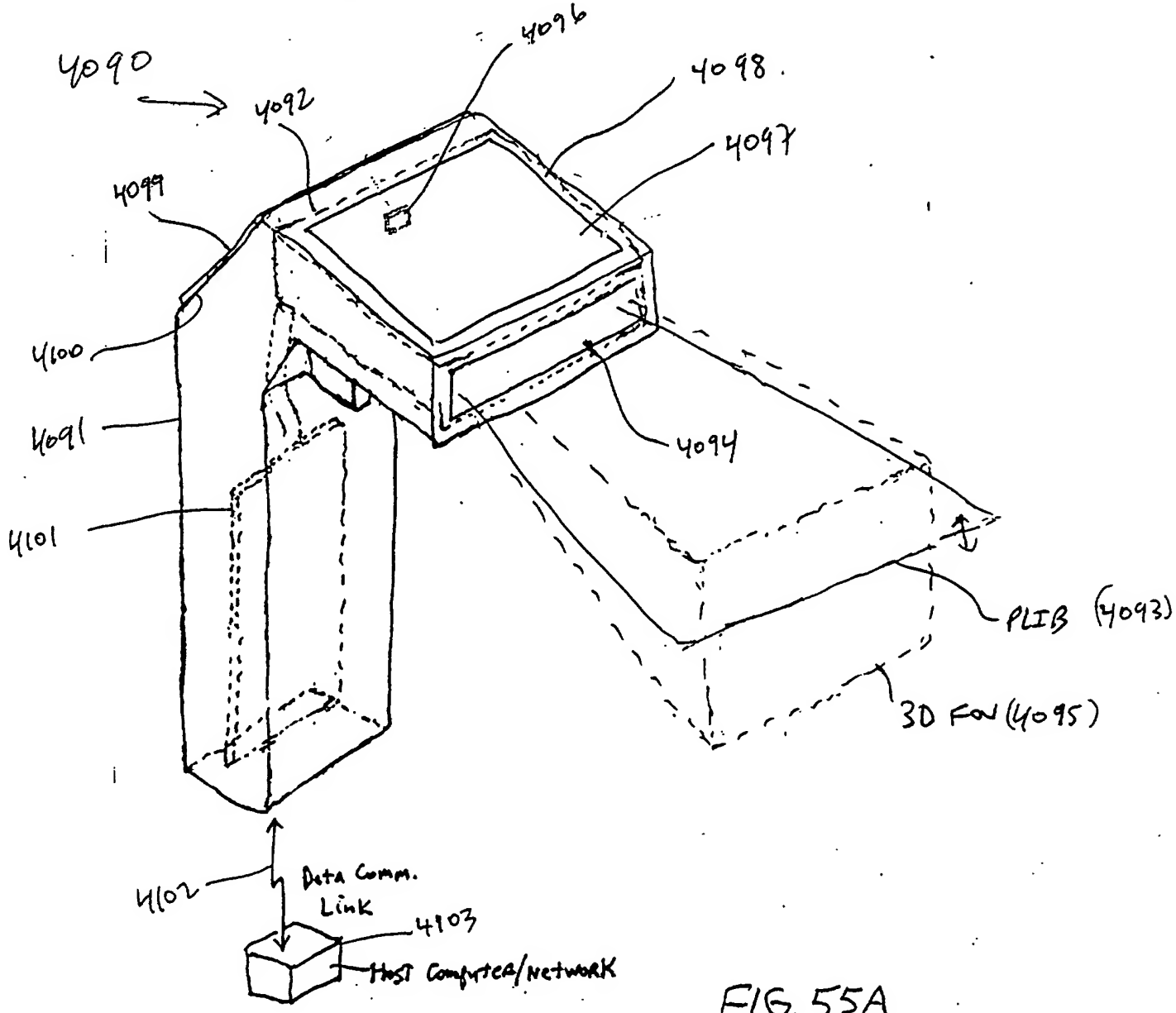


FIG. 55A

20070282649 - 20070282649

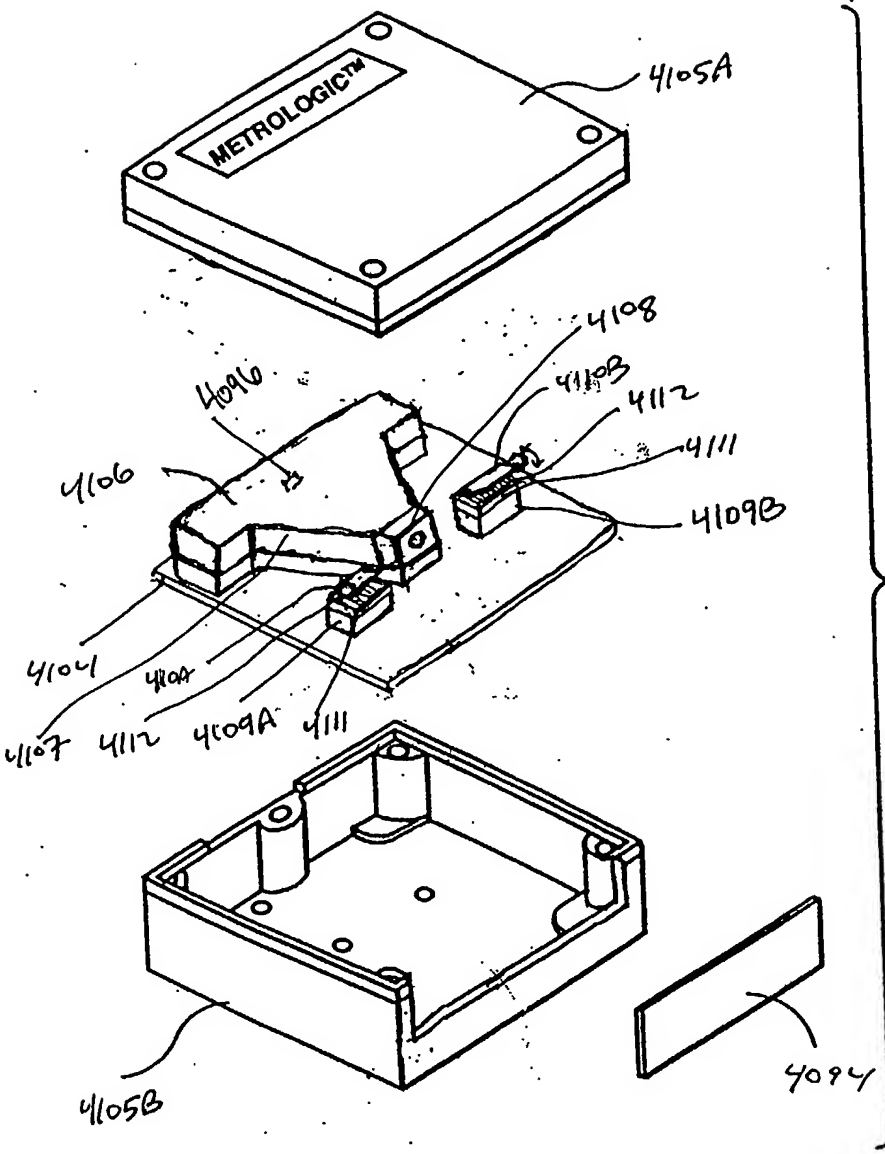


FIG. 55B

Bragg cell – Fig. 11 6A–6B

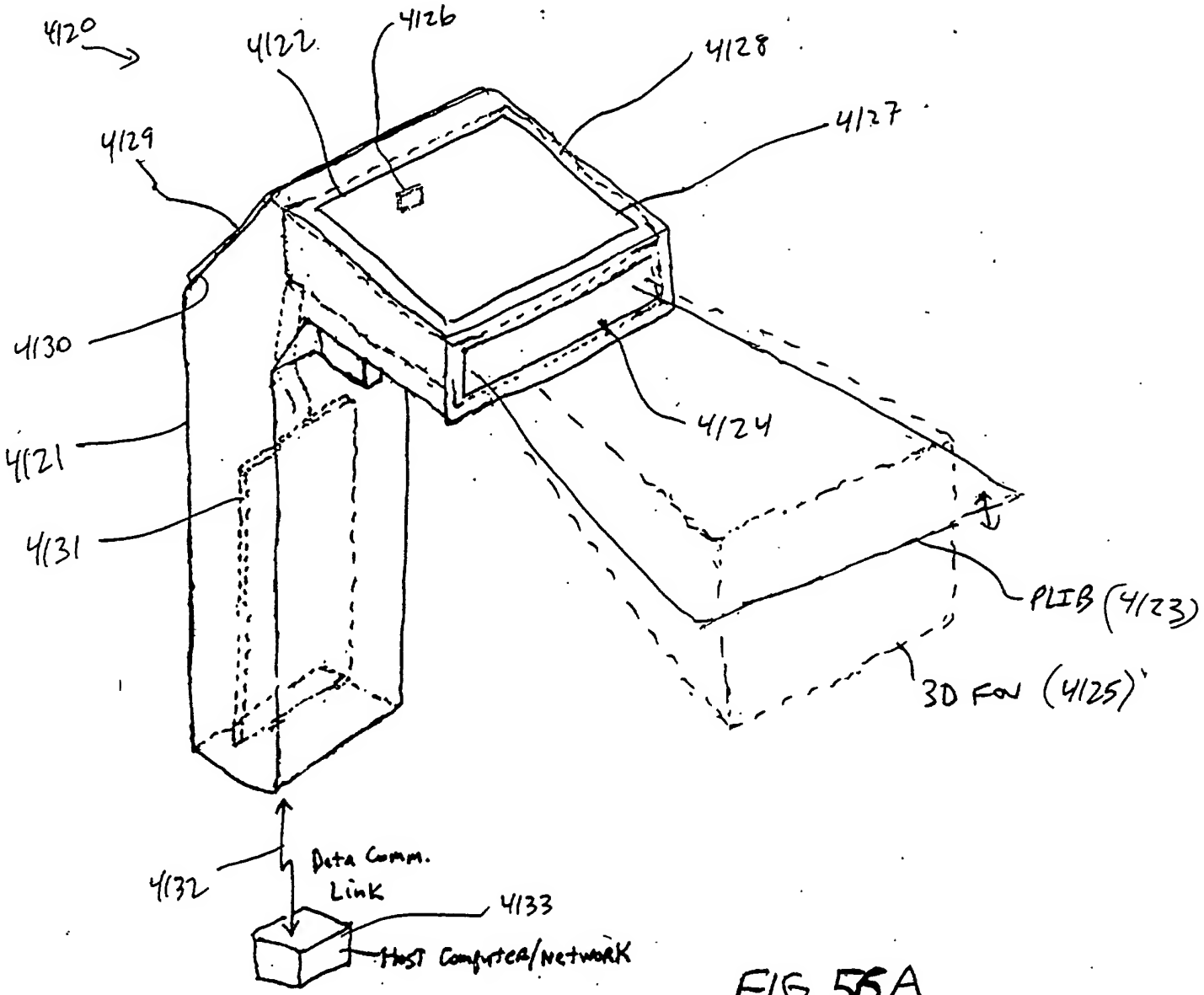


FIG. 56A

20020220 • 2003-0004801

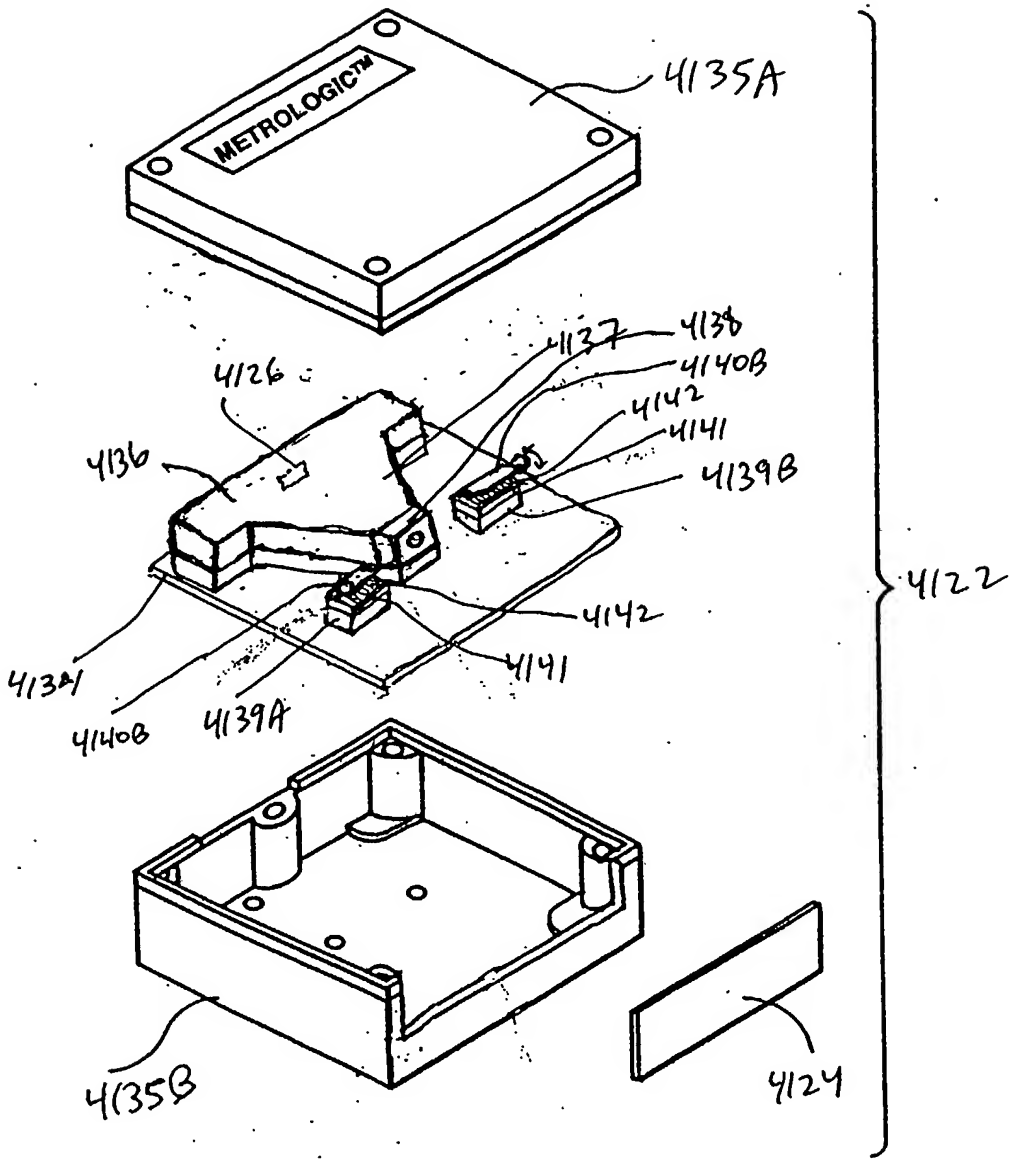


FIG. 56B

DM

Fig. II 7A-7C

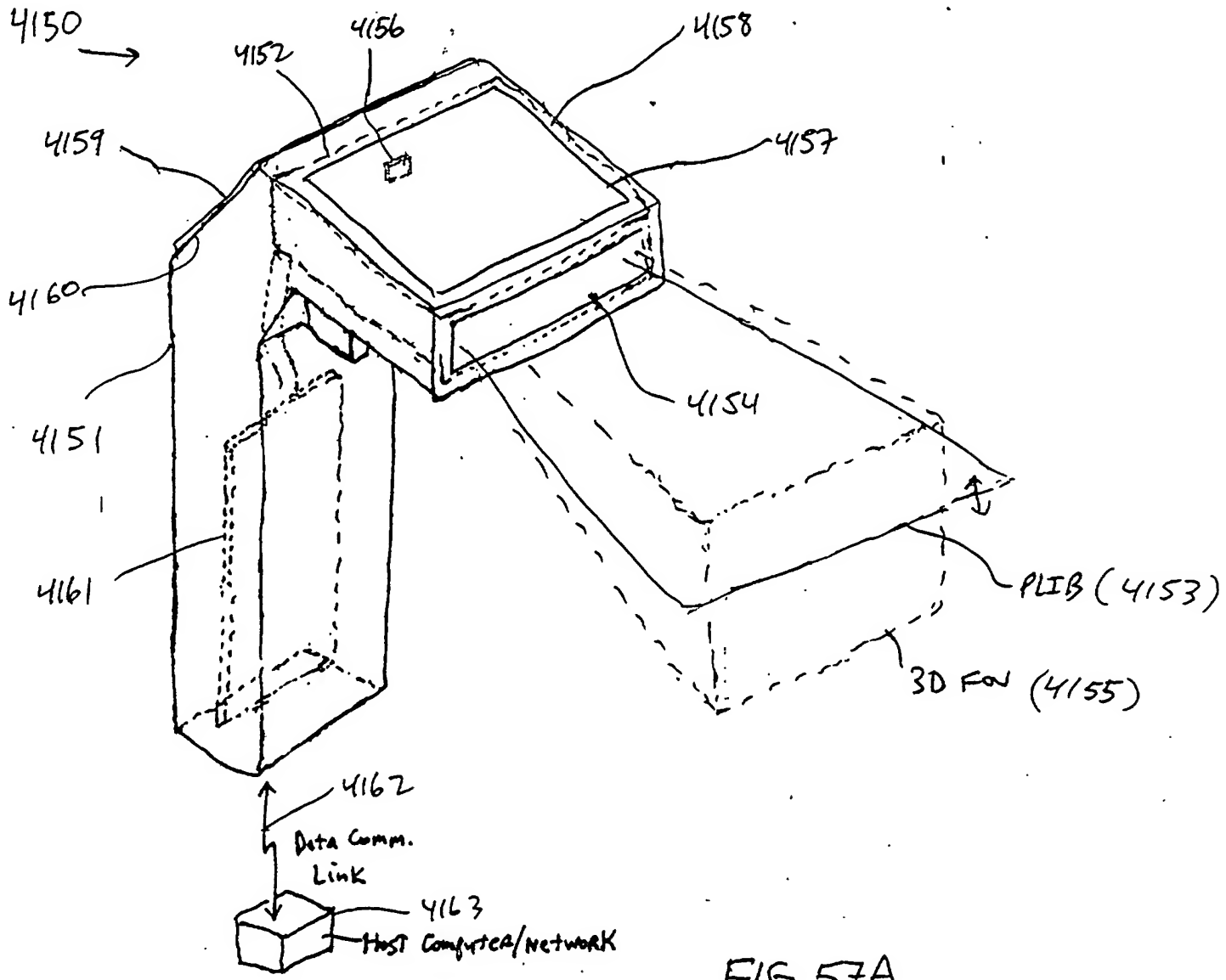


FIG. 57A

WO 2006/042077 PCT/US2005/036457

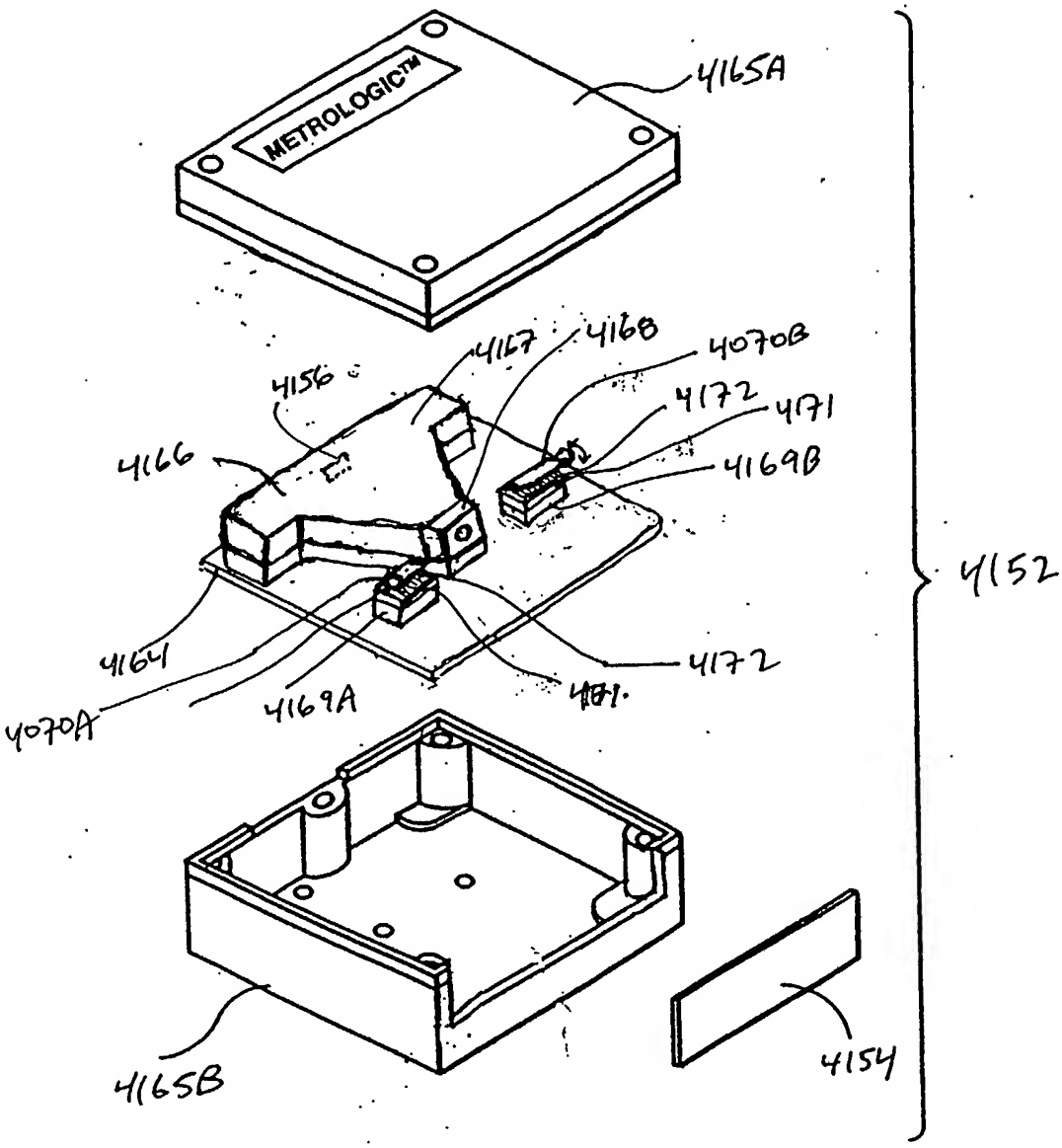


FIG. 57B

Please only LCD Pkn panel

Figs 17 8F-86

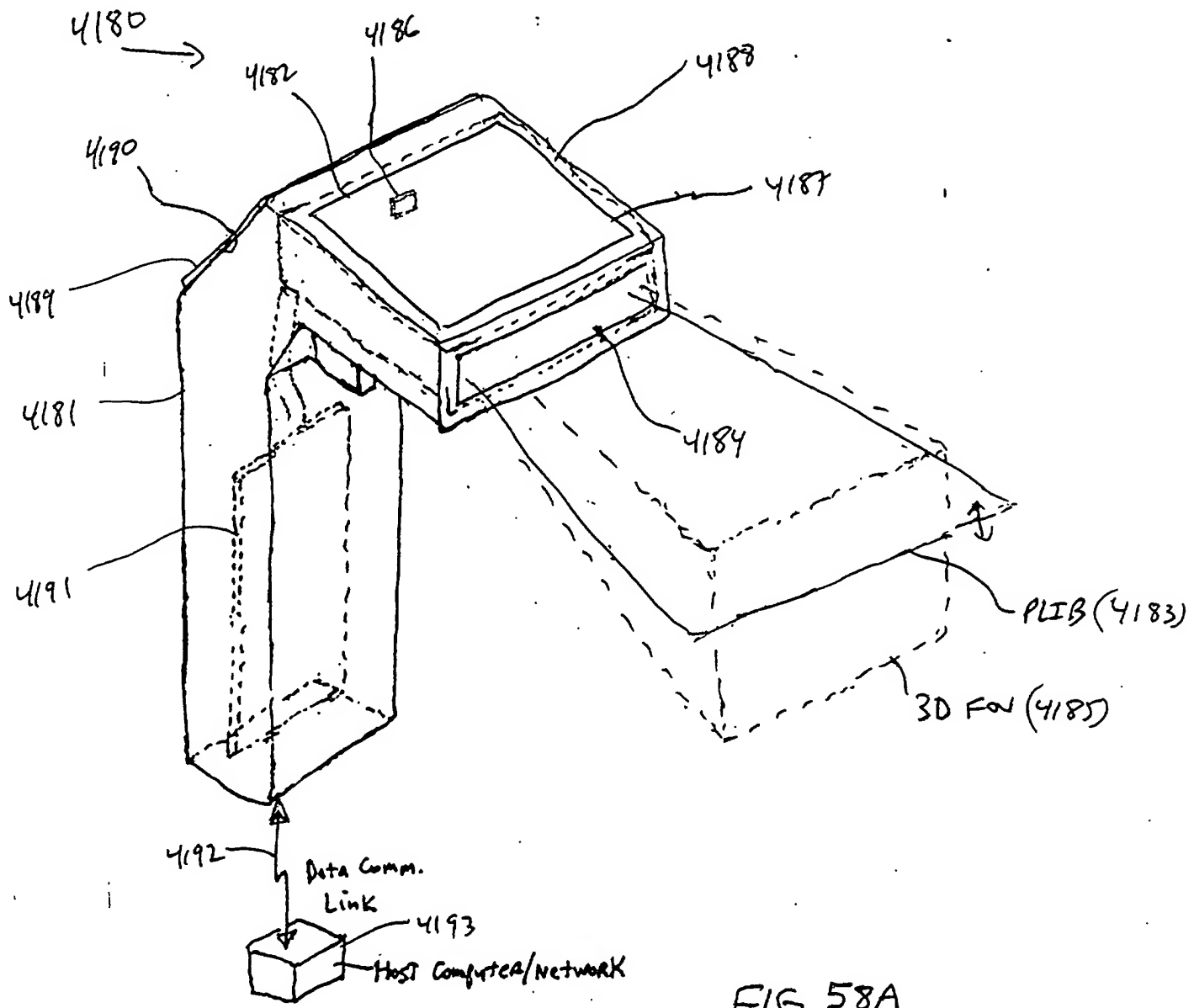

4180
4182
4186
4188
4190
4187
4189
4181
4184
4191
PLIB (4183)
3D FOV (4185)
4192
Data Comm. Link
4193
Host Computer/Network

FIG. 58A

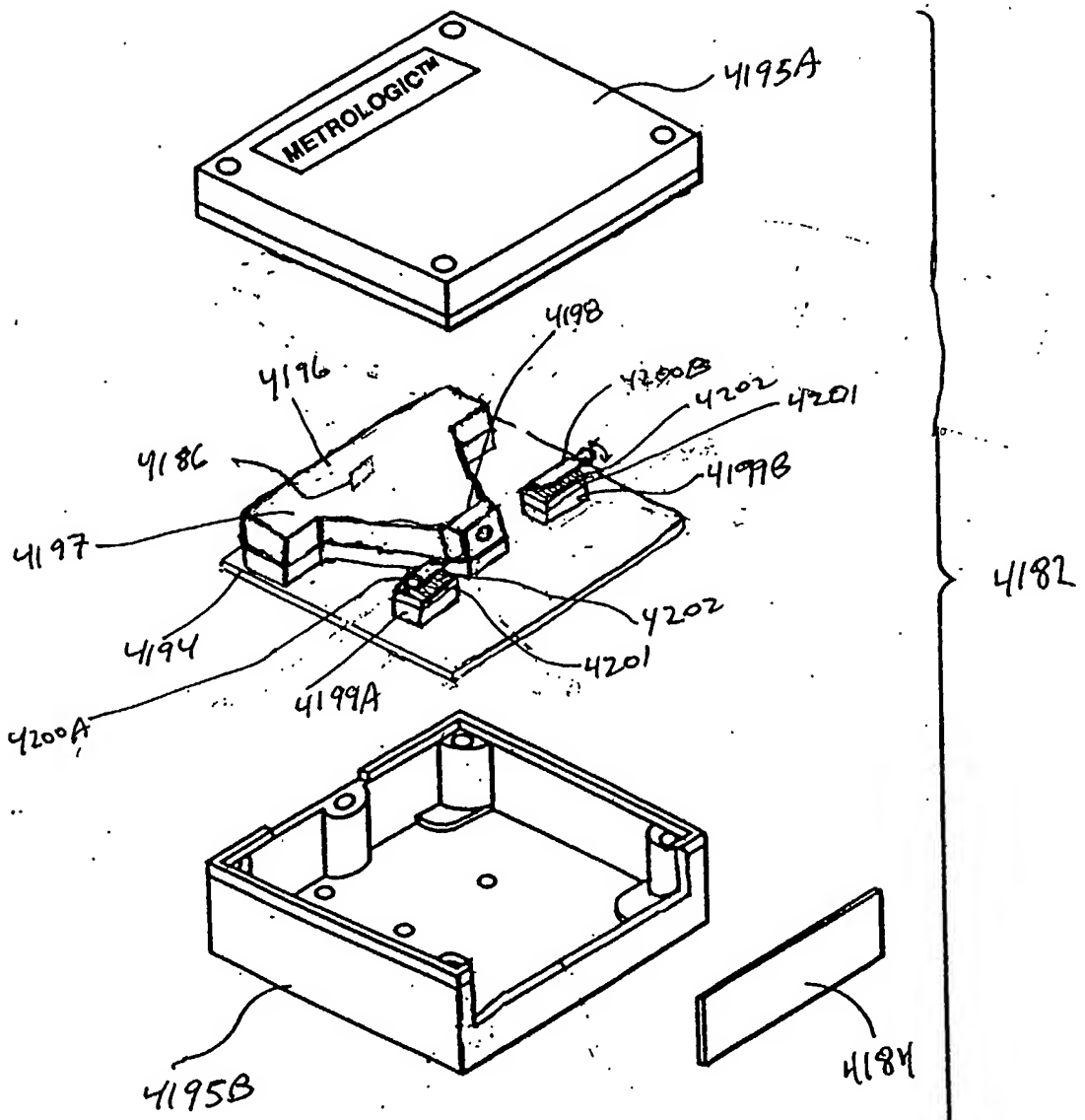


FIG. 58B

Hs optical shutter
Fig. 1F 14A-14B

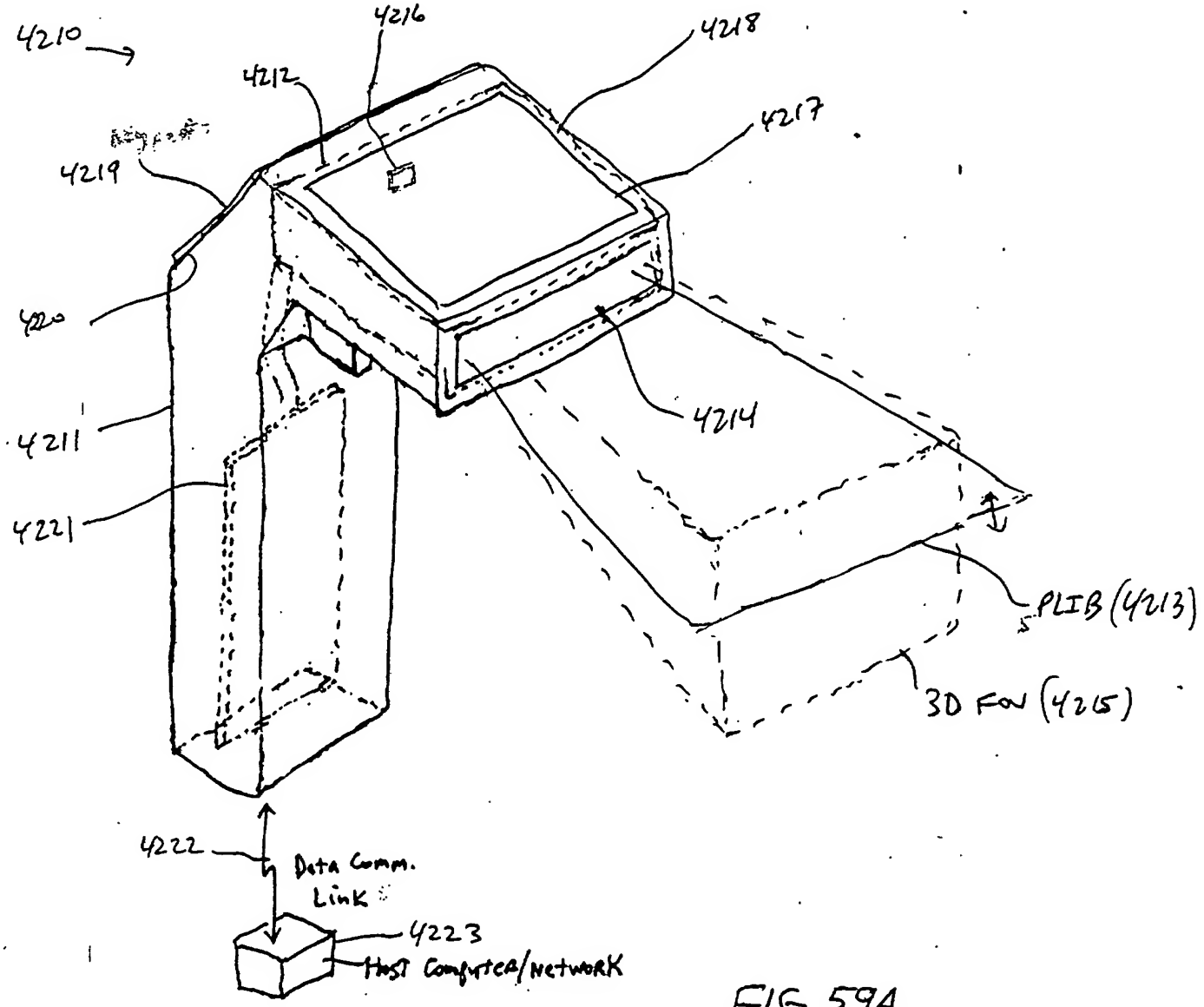

4210
4216
4218
4212
4217
4219
4220
4214
4211
4221
PLIB (4213)
3D FOV (4215)
4222
Data Comm. Link
4223
Host Computer/Network

FIG. 59A

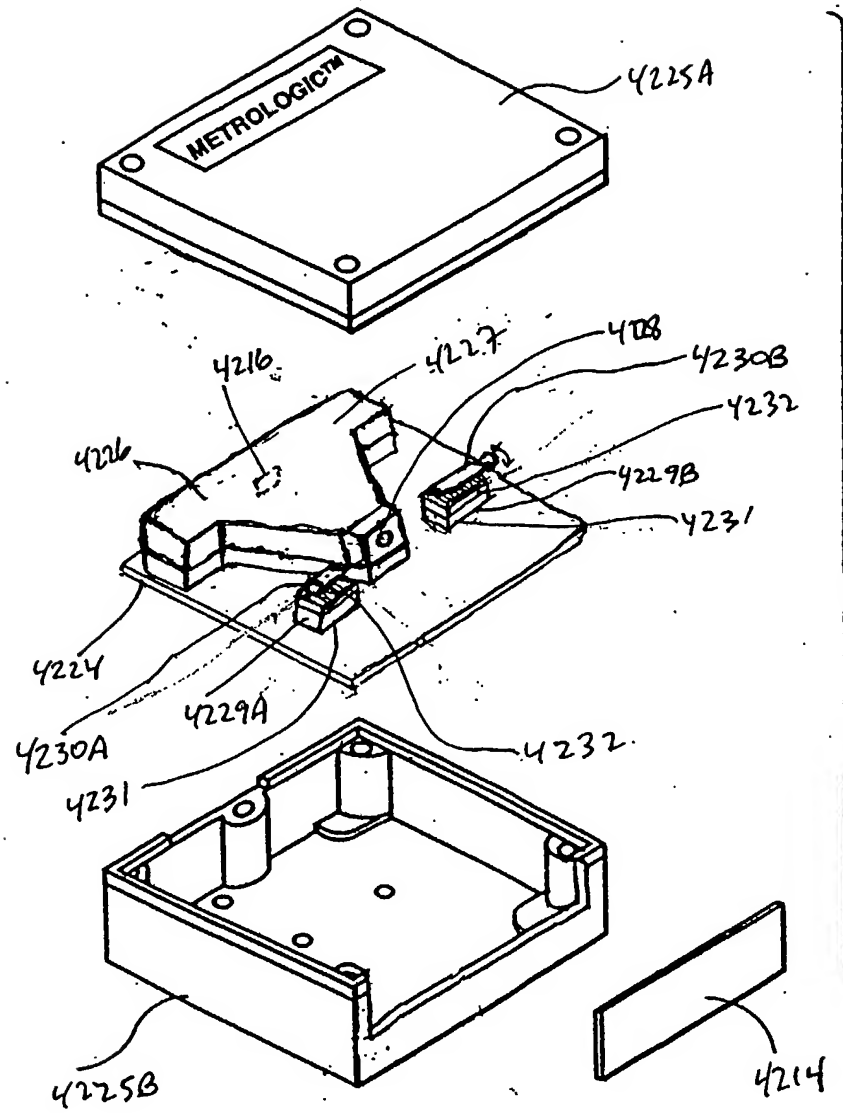


FIG. 59B

MCLD
Fig. 1I 15A-15B

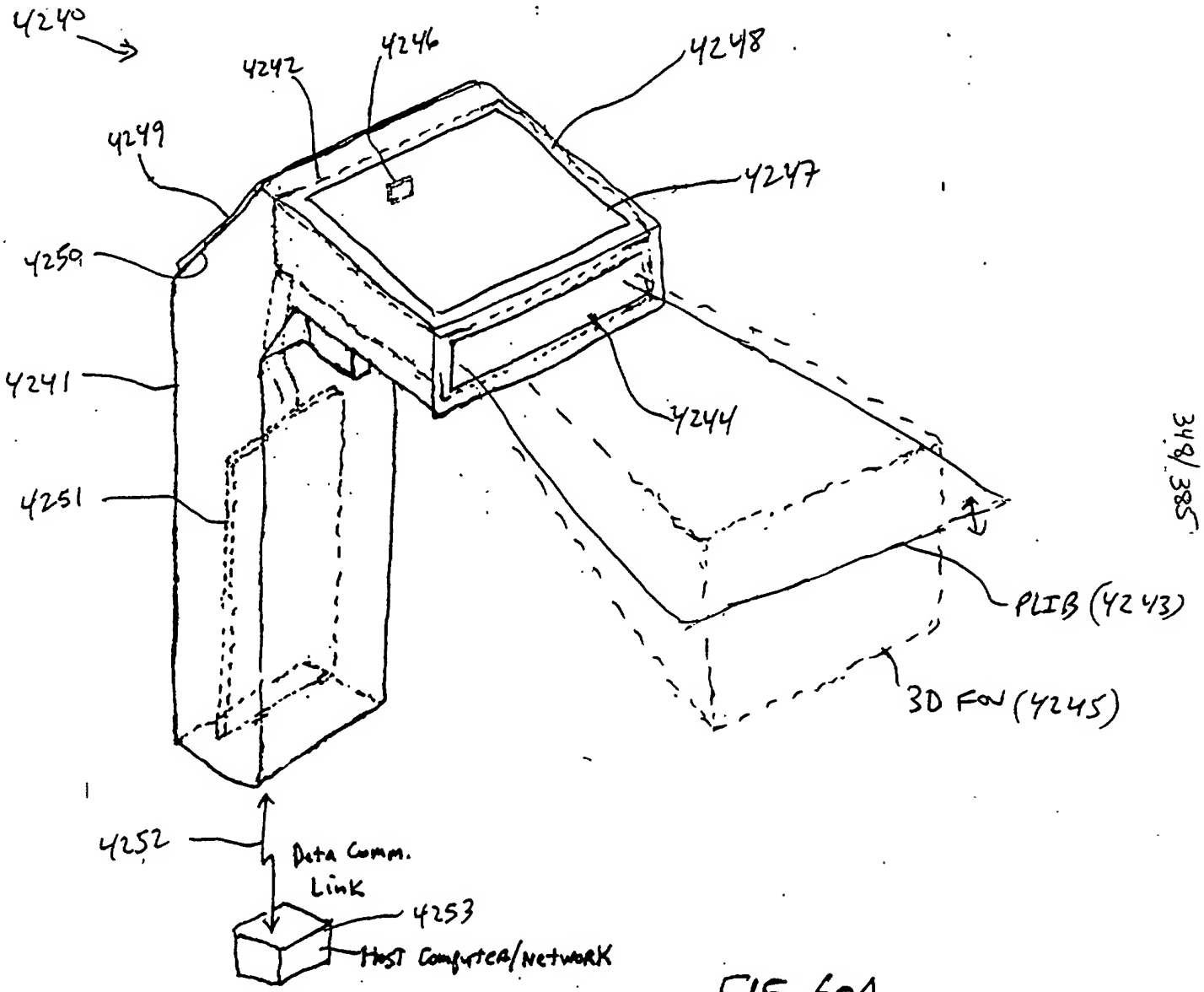


FIG. 60A

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20220207 US 2022040807 A1

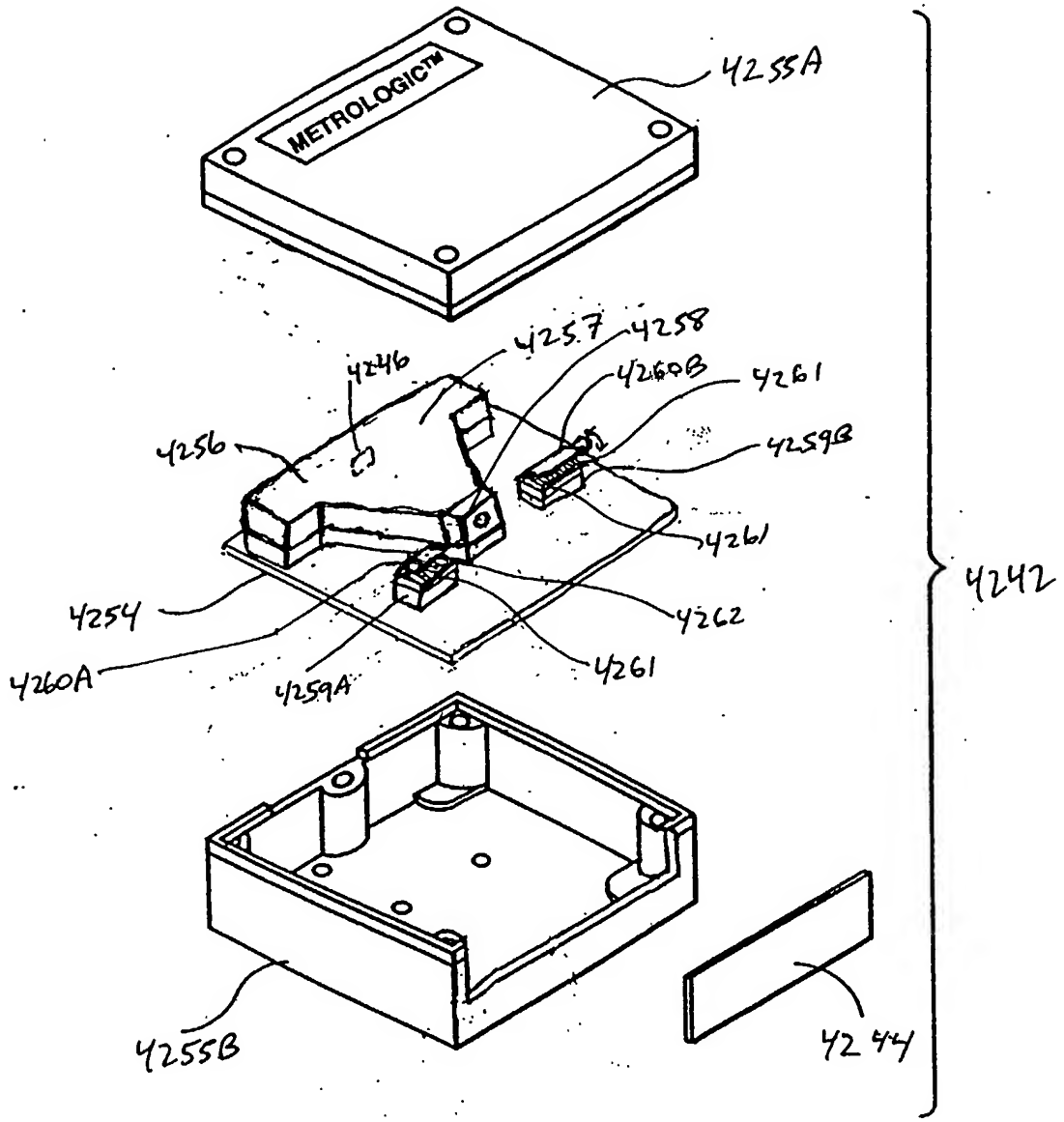

FIG. 60B

(Tang. phase mod.)
Bathalon
Fig. 1I17A-17B

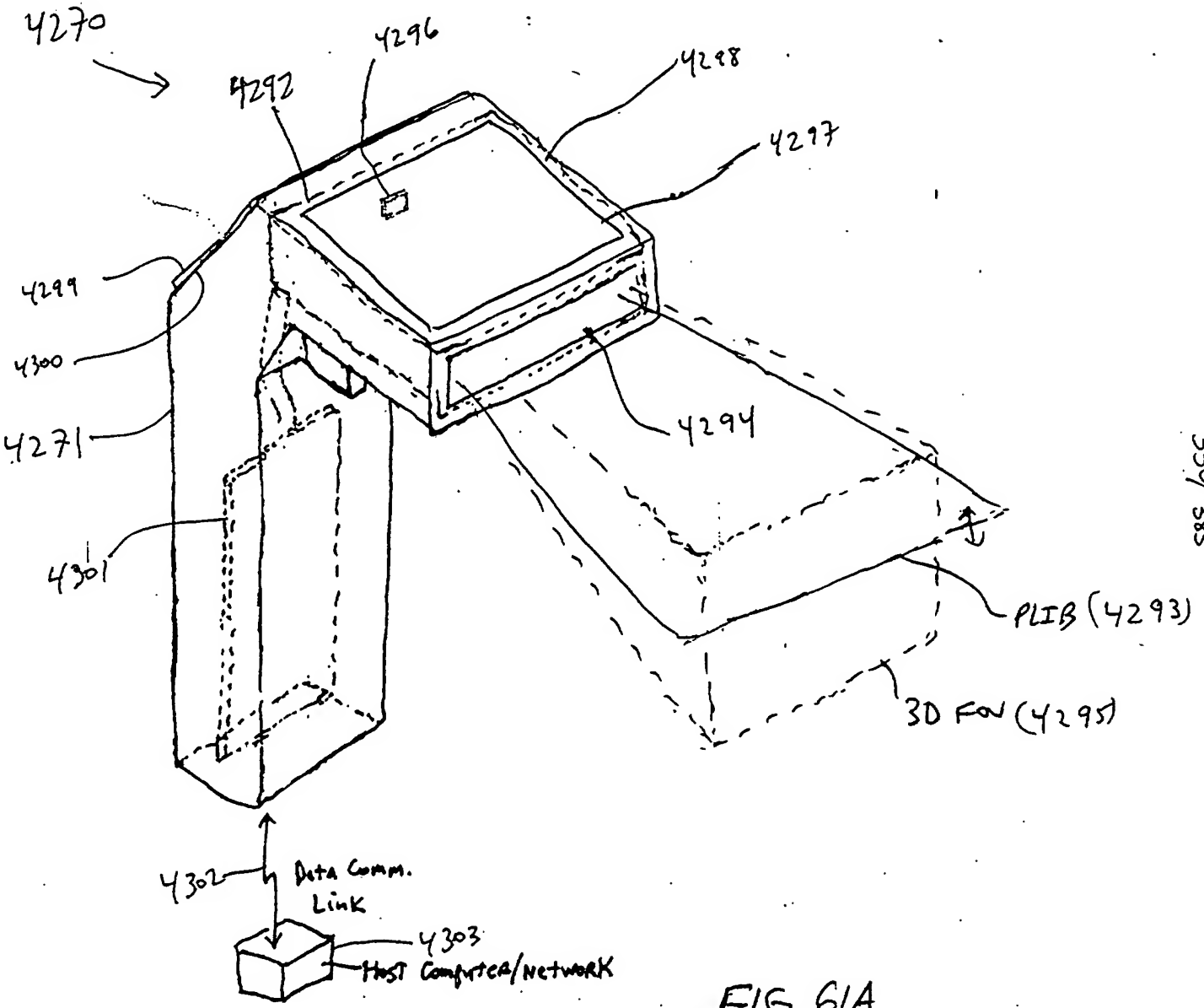
4270
4296
4292
4298
4297
4299
4300
4271
4294
4301
350/385
PLIB (4293)
3D FOV (4295)
4302
Data Comm. Link
4303
Host Computer/Network

FIG. 61A

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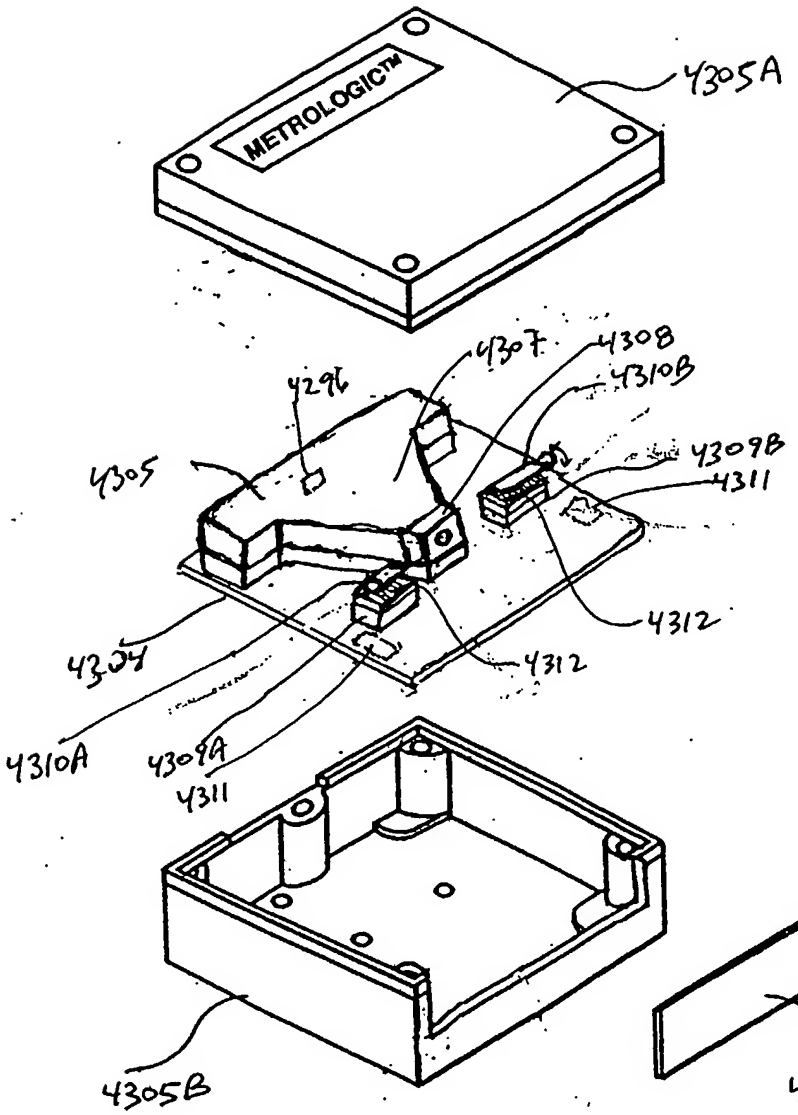

FIG. 61B

mod. mapping
Fig. ~~11~~ 19A-19B

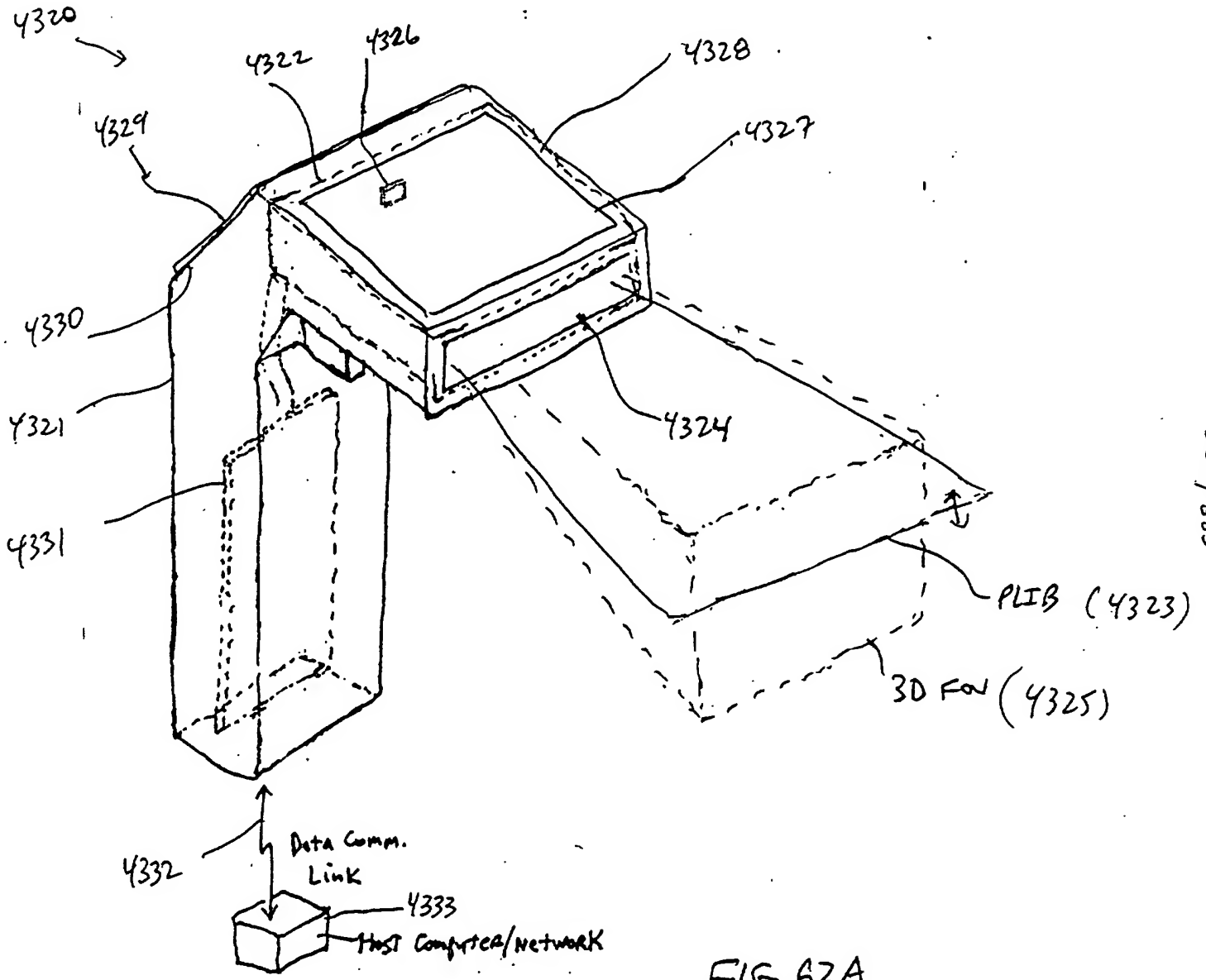

FIG. 62A

352/385

20422250 "2283+8CDT

353/385

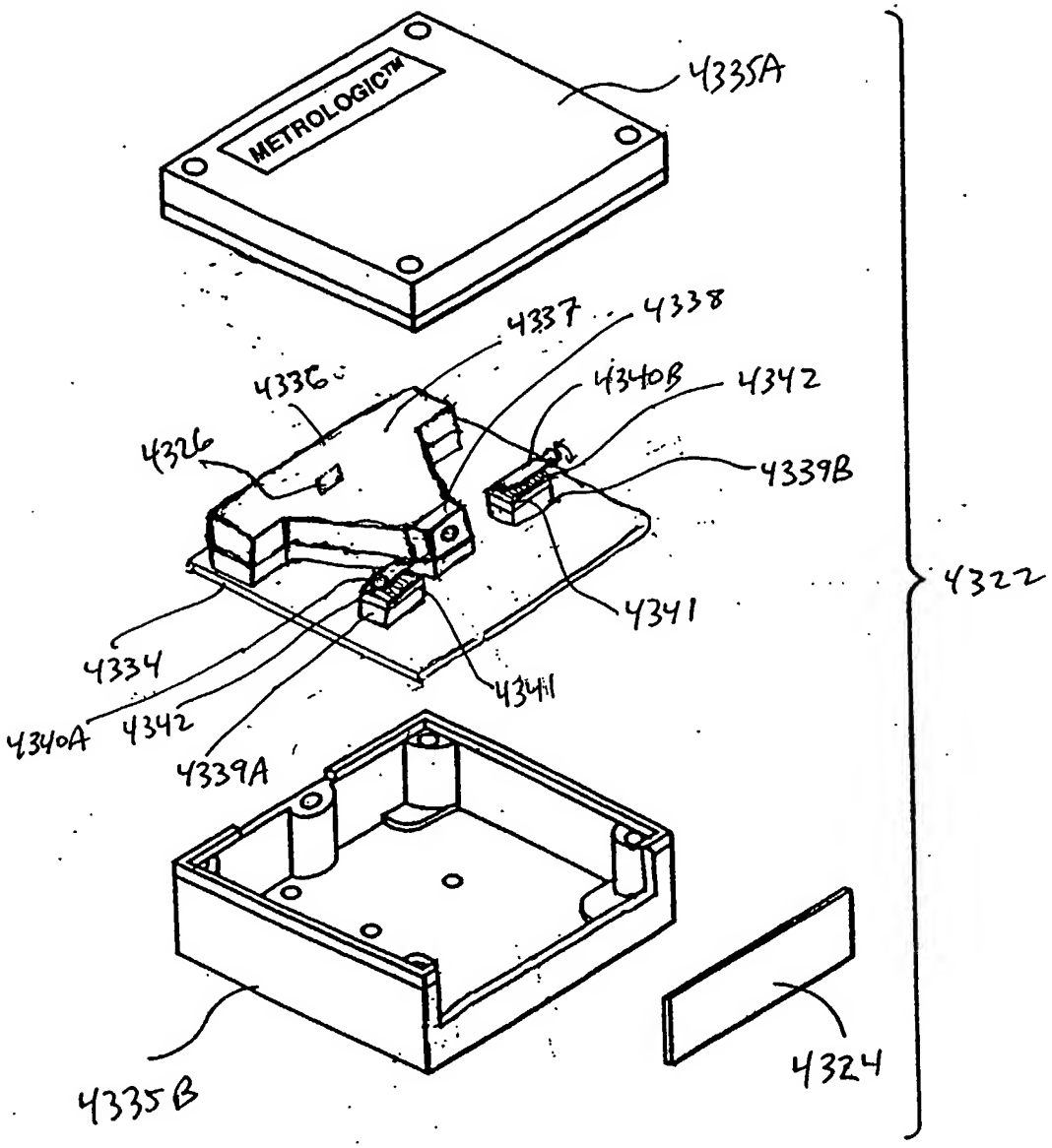

FIG. 62B

mem oscillin
spot int intensity
mod. panel

Fig. 1F21A-21D

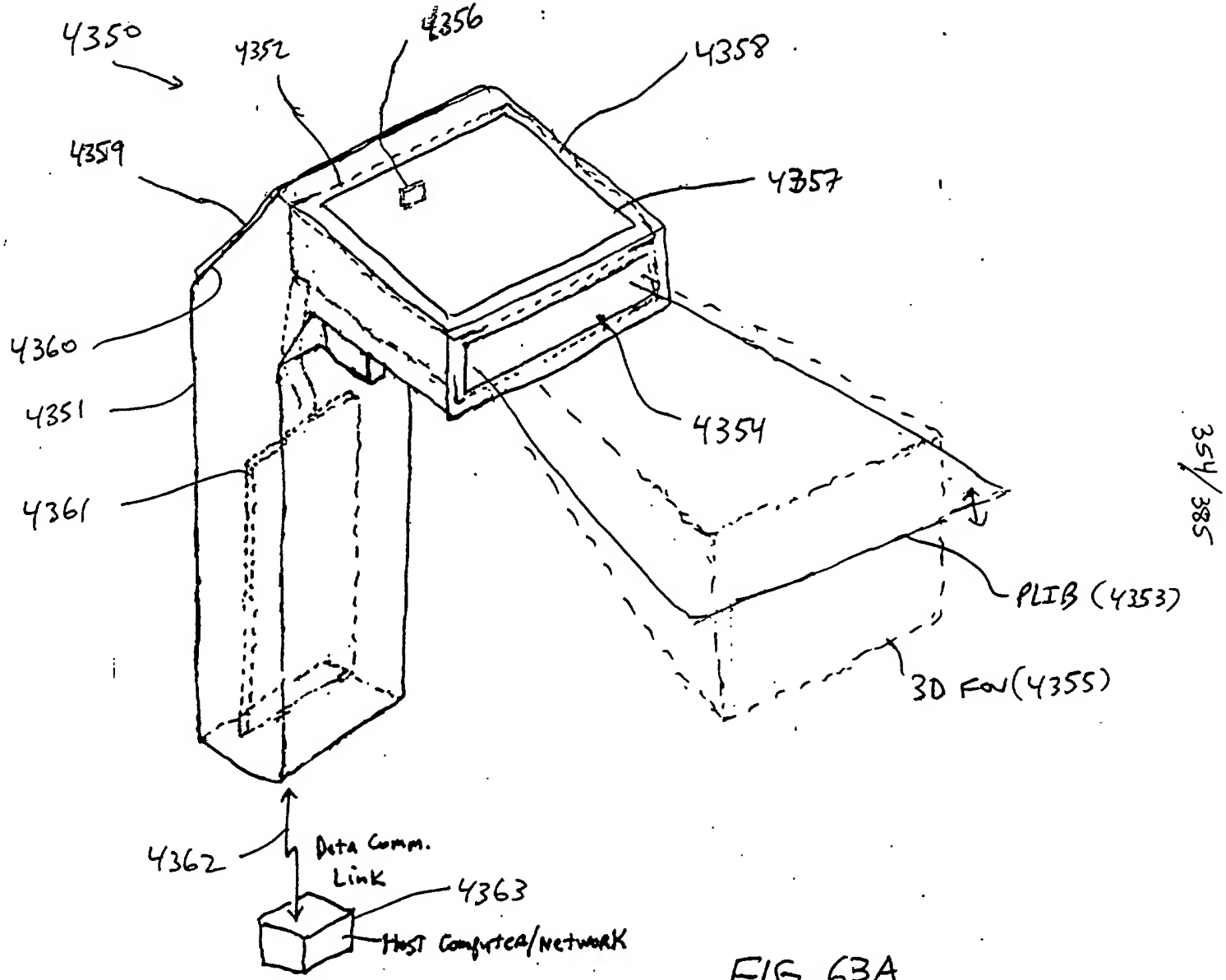

FIG. 63A

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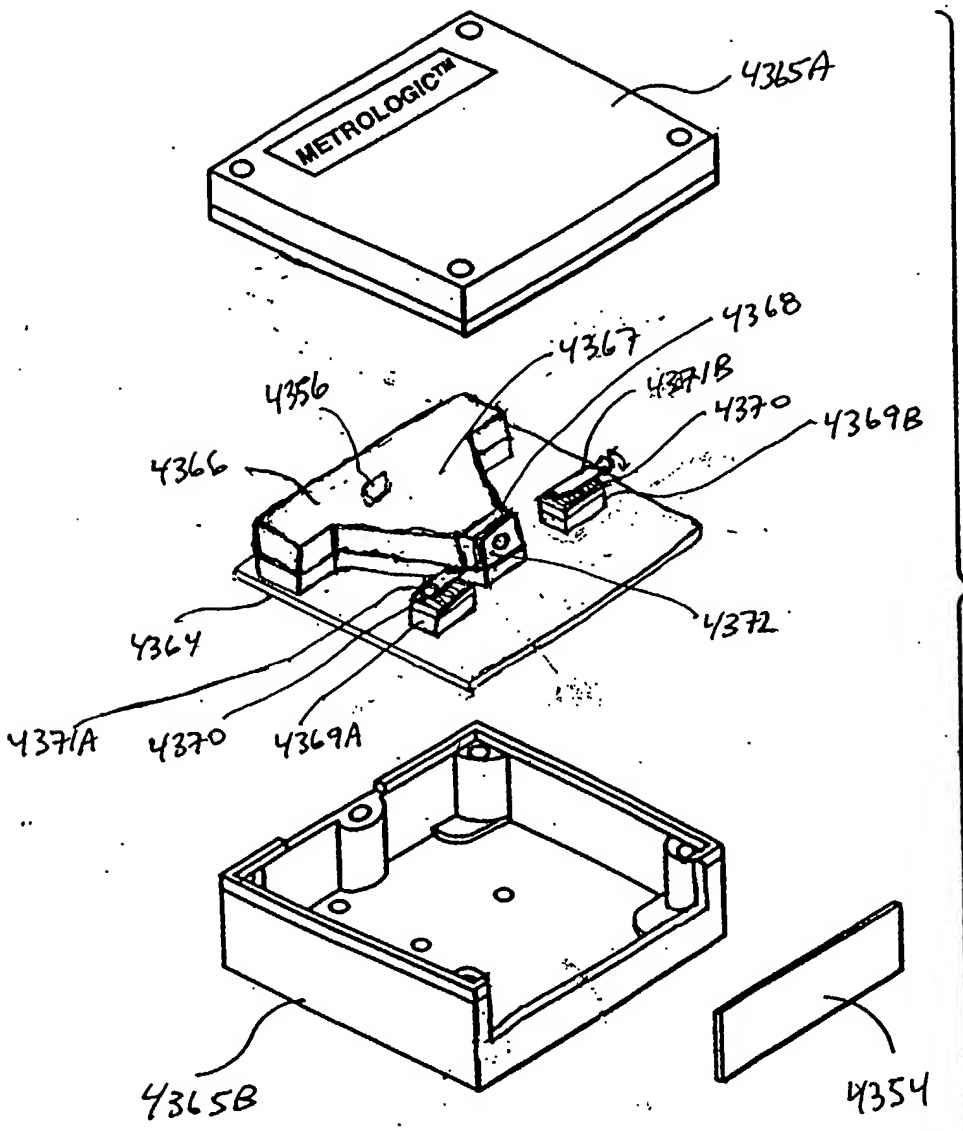

FIG. 63B

Ed of. mechanical Rotating IRIS

Fig I 23A - 23B

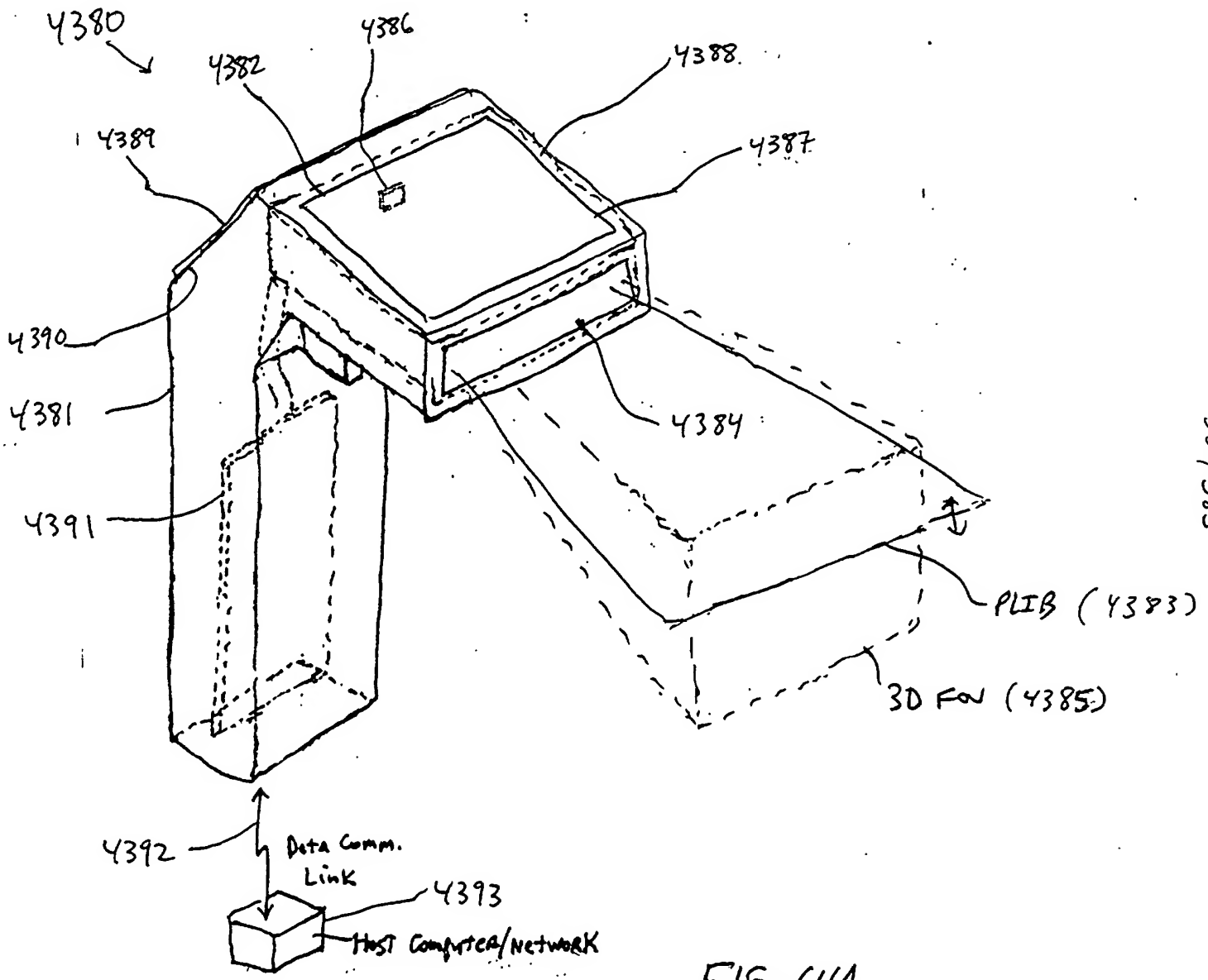

FIG. 64A

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EXHIBIT 1008, PAGE 1008

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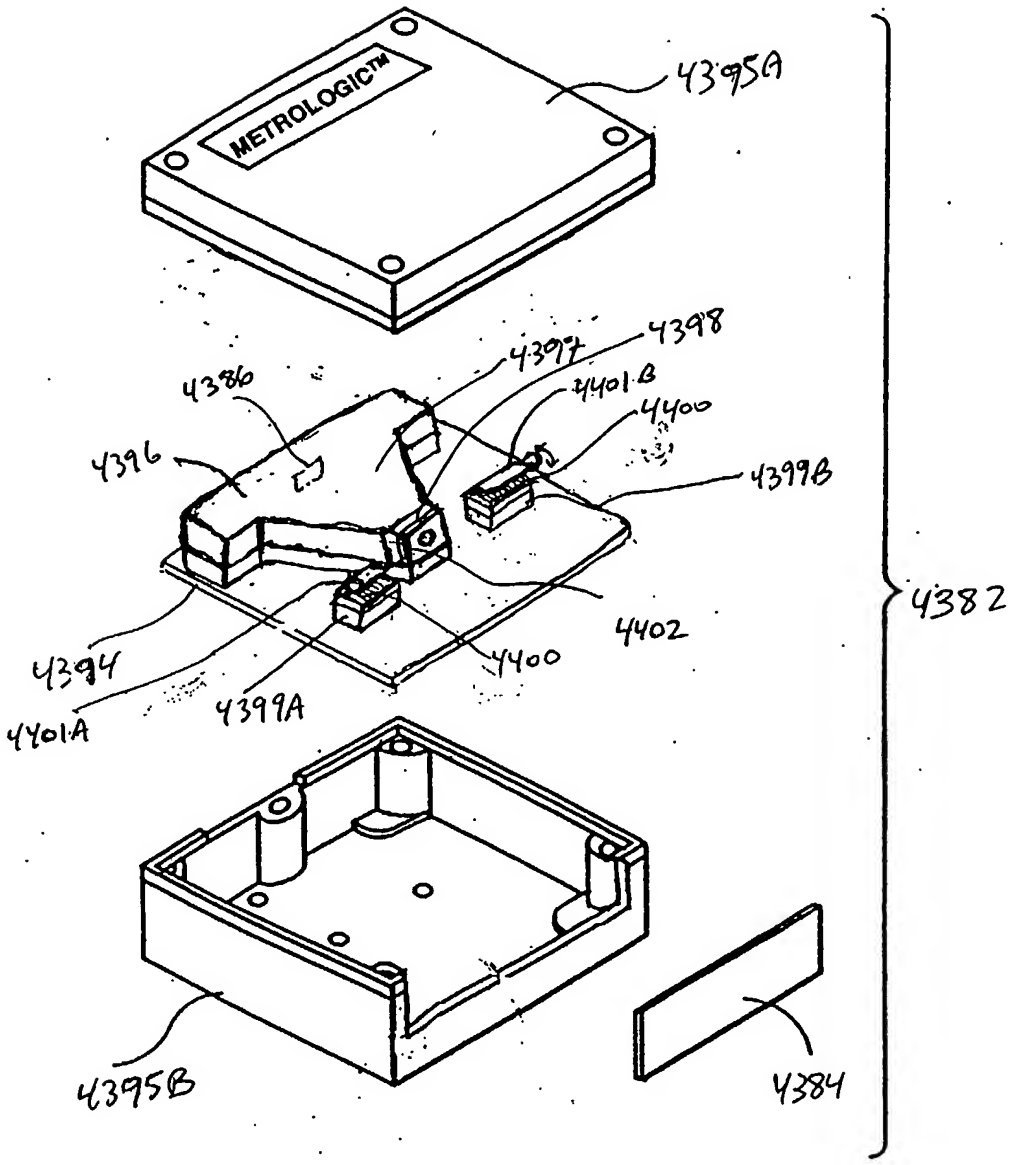

FIG. 64B

* E-optical shutter before IP Cons
Fig. 1I24A

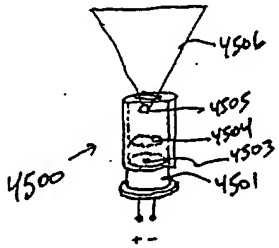

FIG. 65A

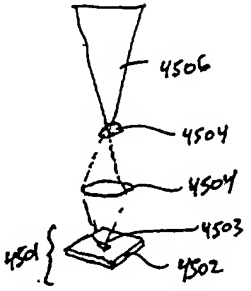

FIG. 65B

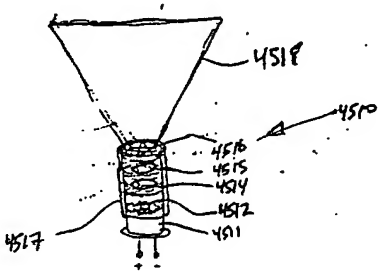

FIG. 66A

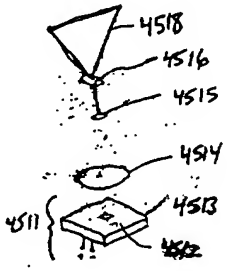

FIG. 66B

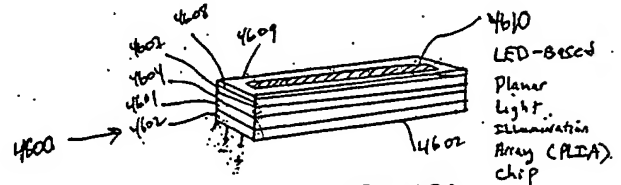

FIG. 67A

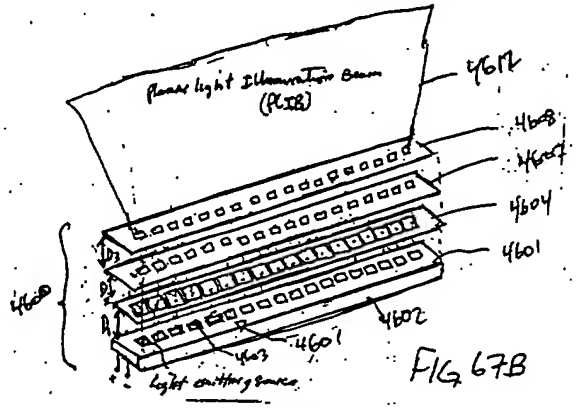

FIG. 67B

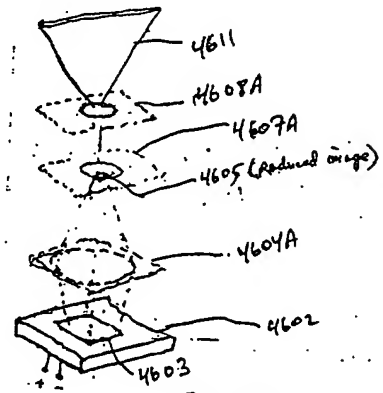

FIG 67C

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20070220.0.1258.0.8005.1

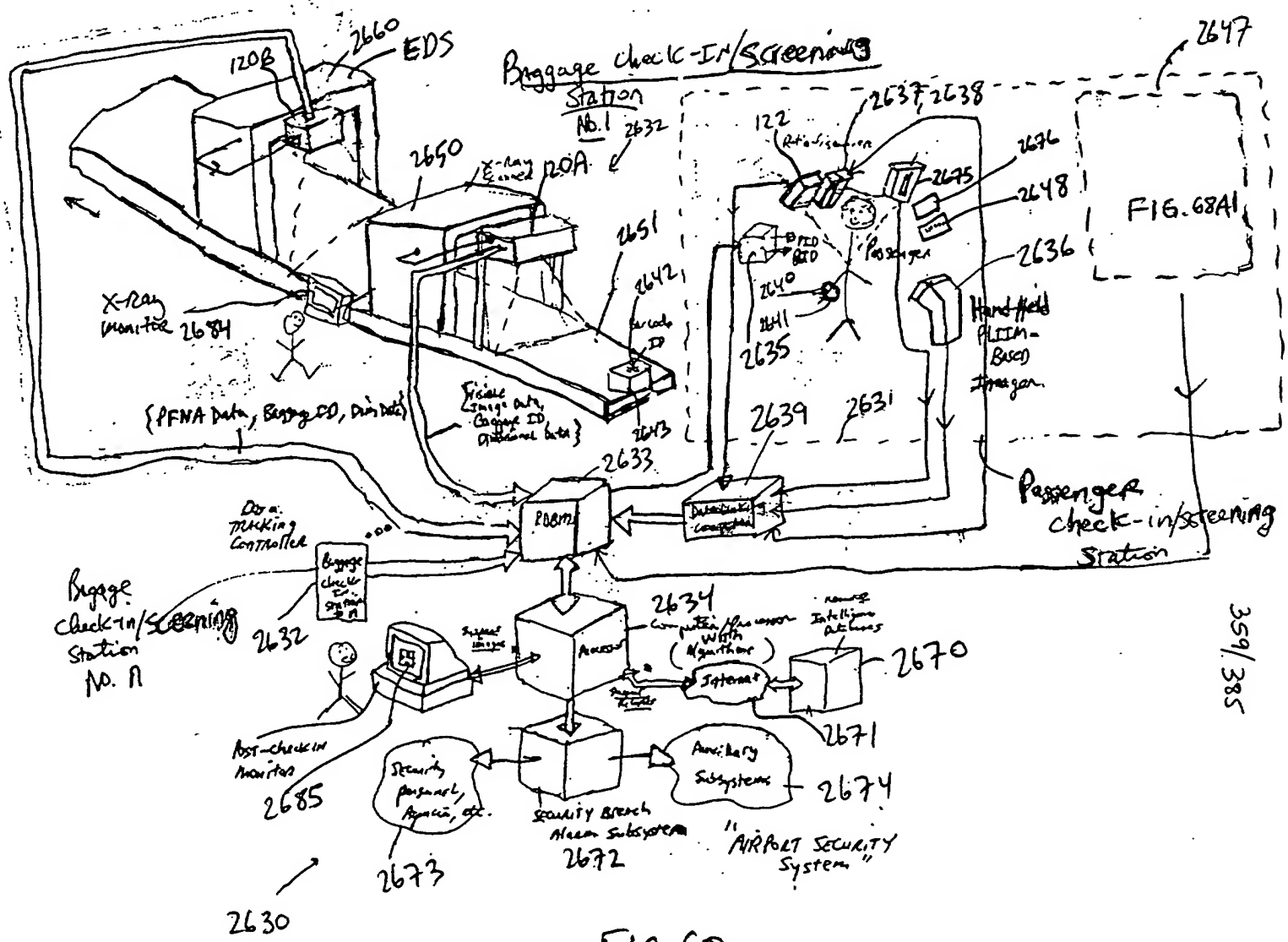
Baggage check-In/Screening Station No. 1
2660
EDS
1208
2650
2632
2651
2642
2643
2684
X-Ray monitor
{PFNA Data, Baggage ID, Visible Image data, Baggage ID, Additional data}
2633
PBBM
2639
2631
2635
2636
2637, 2638
122
2676
2675
2648
2647
FIG. 68A1
Hand Held PFNA-Based Imager
Passenger check-in/screening station
Data Tracking Controller
Baggage check-in/screening station No. N
2632
2634
2670
2671
2674
Ancillary Subsystems
"AIRPORT SECURITY System"
Security Personnel, Agencies, etc.
2673
Security Breach Alarm Subsystem
2672
Post-check-in monitor
2685
2630

FIG. 68.

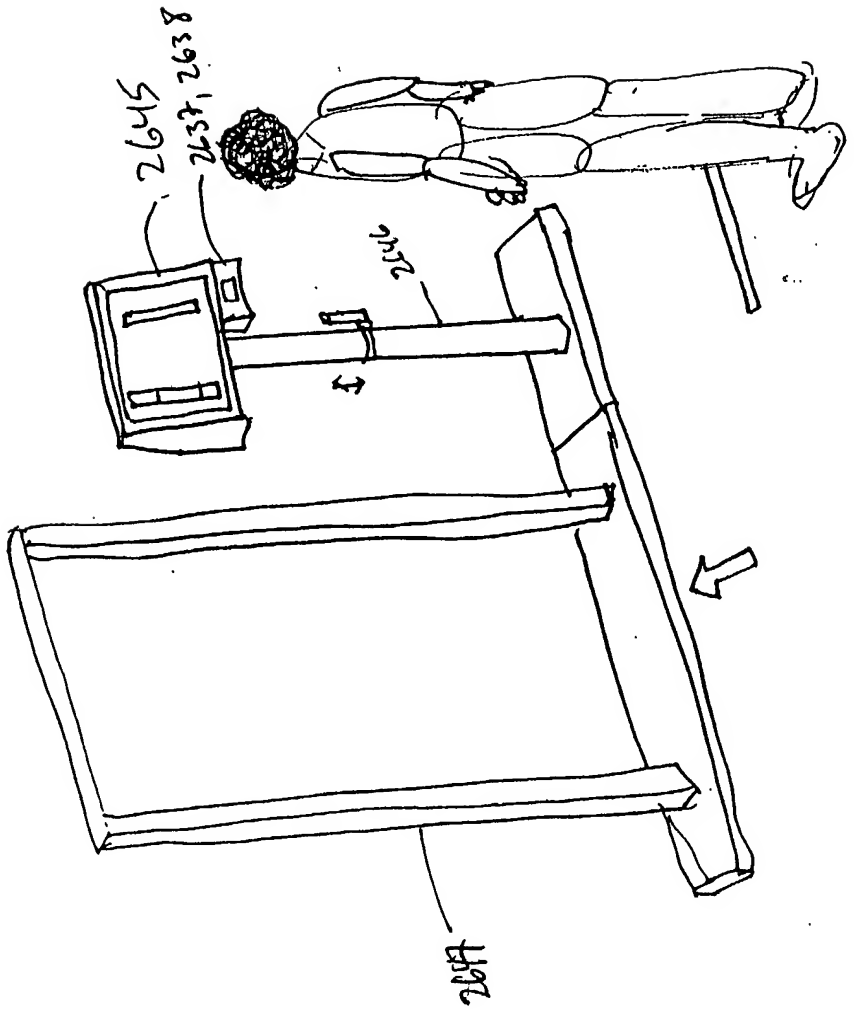

FIG. 68A

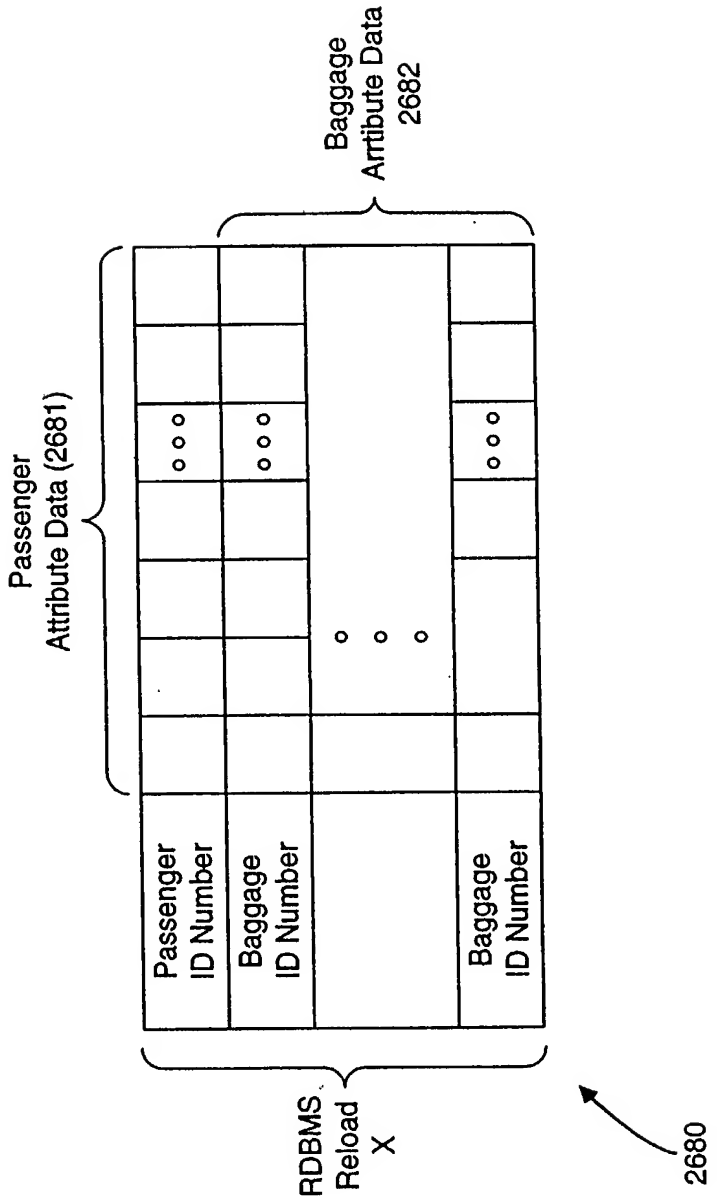
Passenger
Attribute Data (2681)
Baggage
Arrtibute Data
2682
Passenger
ID Number
Baggage
ID Number
Baggage
ID Number
RDBMS
Reload
X
2680

FIG. 68B

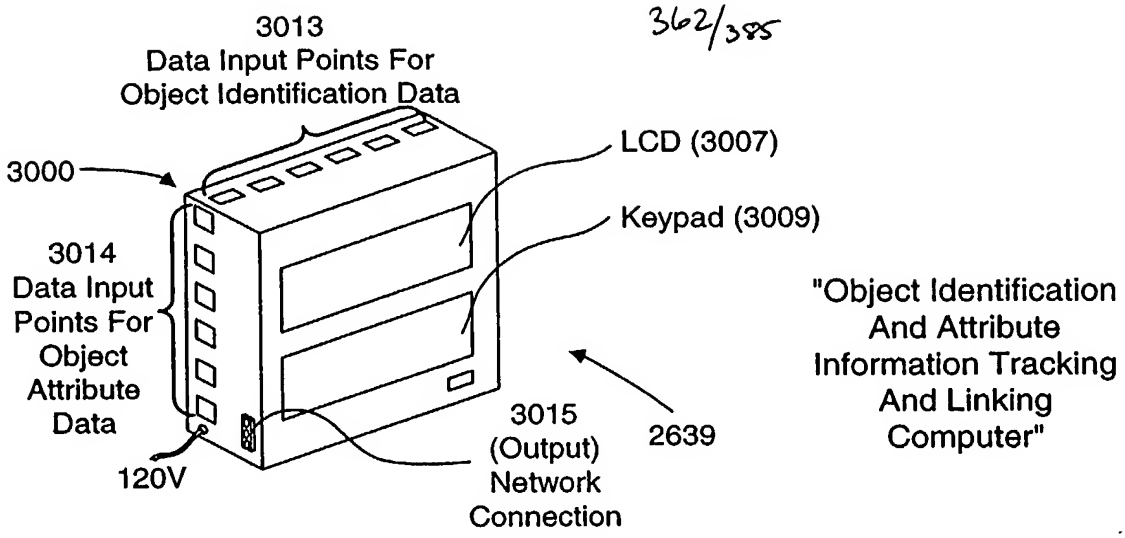

FIG. 68C1

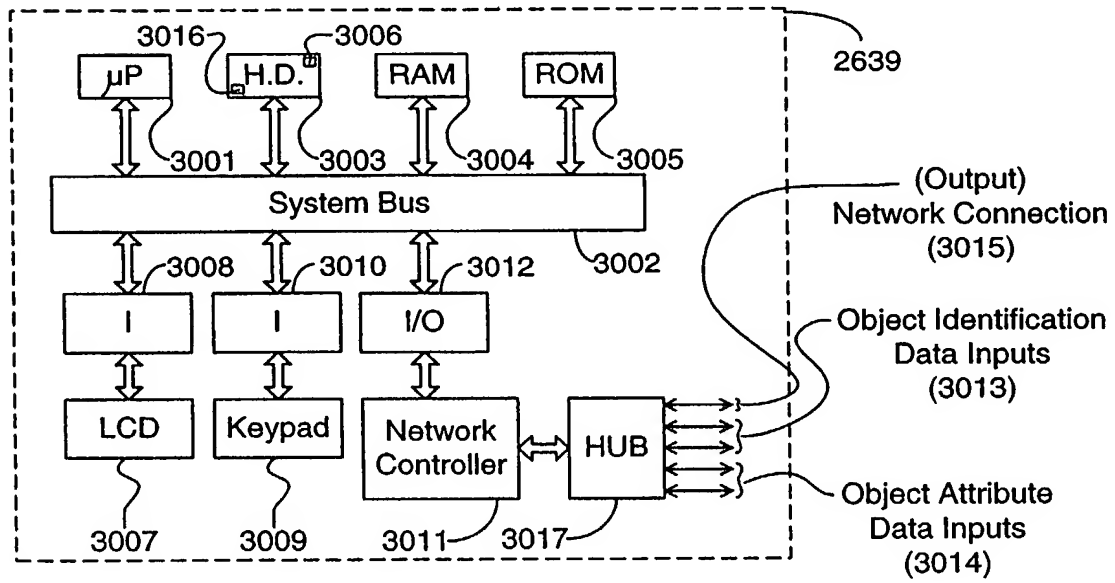

FIG. 68C2

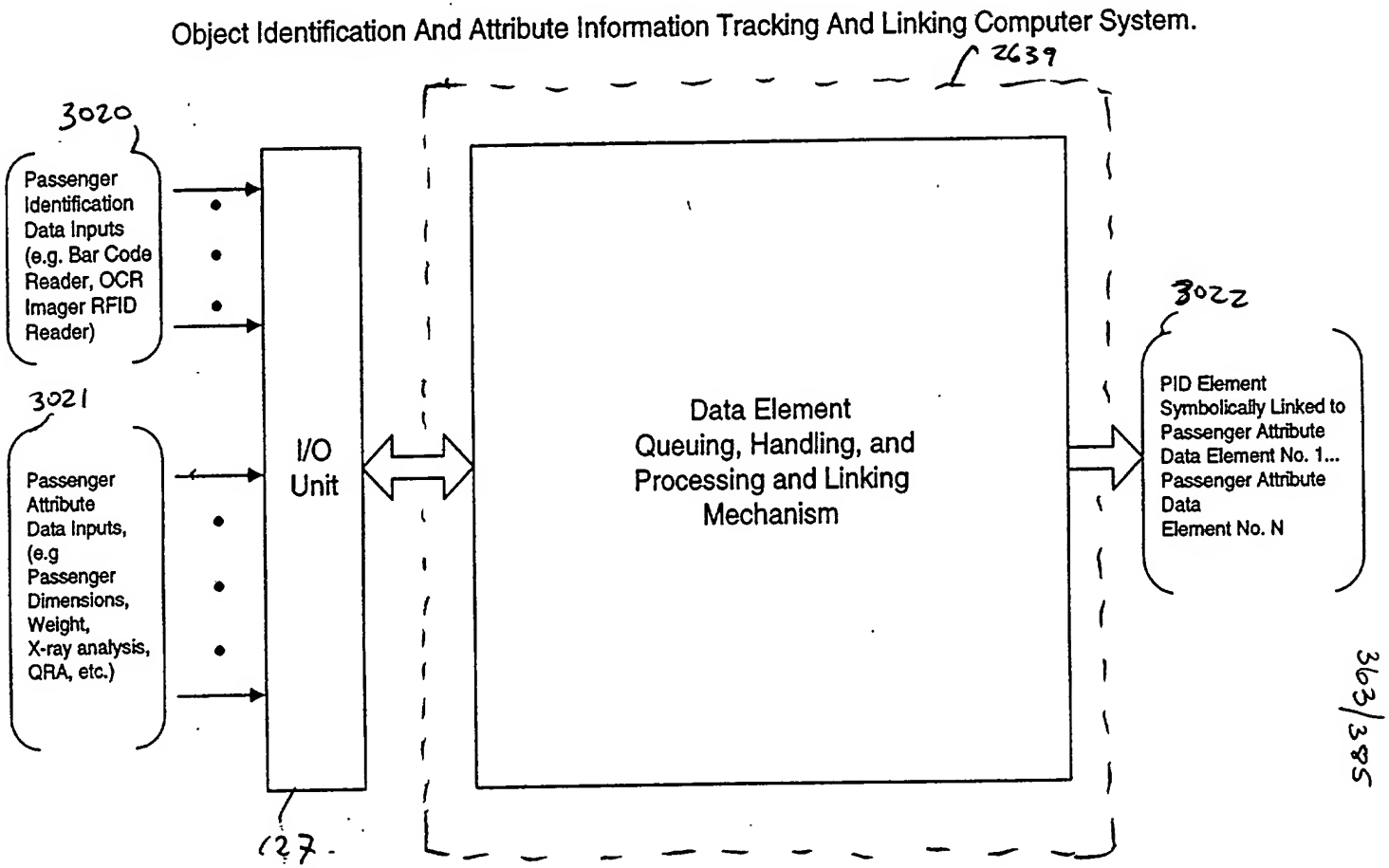
Object Identification And Attribute Information Tracking And Linking Computer System.
2639
3020
Passenger Identification Data Inputs (e.g. Bar Code Reader, OCR Imager RFID Reader)
3021
Passenger Attribute Data Inputs, (e.g Passenger Dimensions, Weight, X-ray analysis, QRA, etc.)
I/O Unit
127
Data Element Queuing, Handling, and Processing and Linking Mechanism
3022
PID Element Symbolically Linked to Passenger Attribute Data Element No. 1... Passenger Attribute Data Element No. N
3631385

FIG. 68C3

Data Element Queuing, Handling, and Processing Subsystem Employed In The Object Identification And Attribute Acquisition System Of The Present Invention. (131)

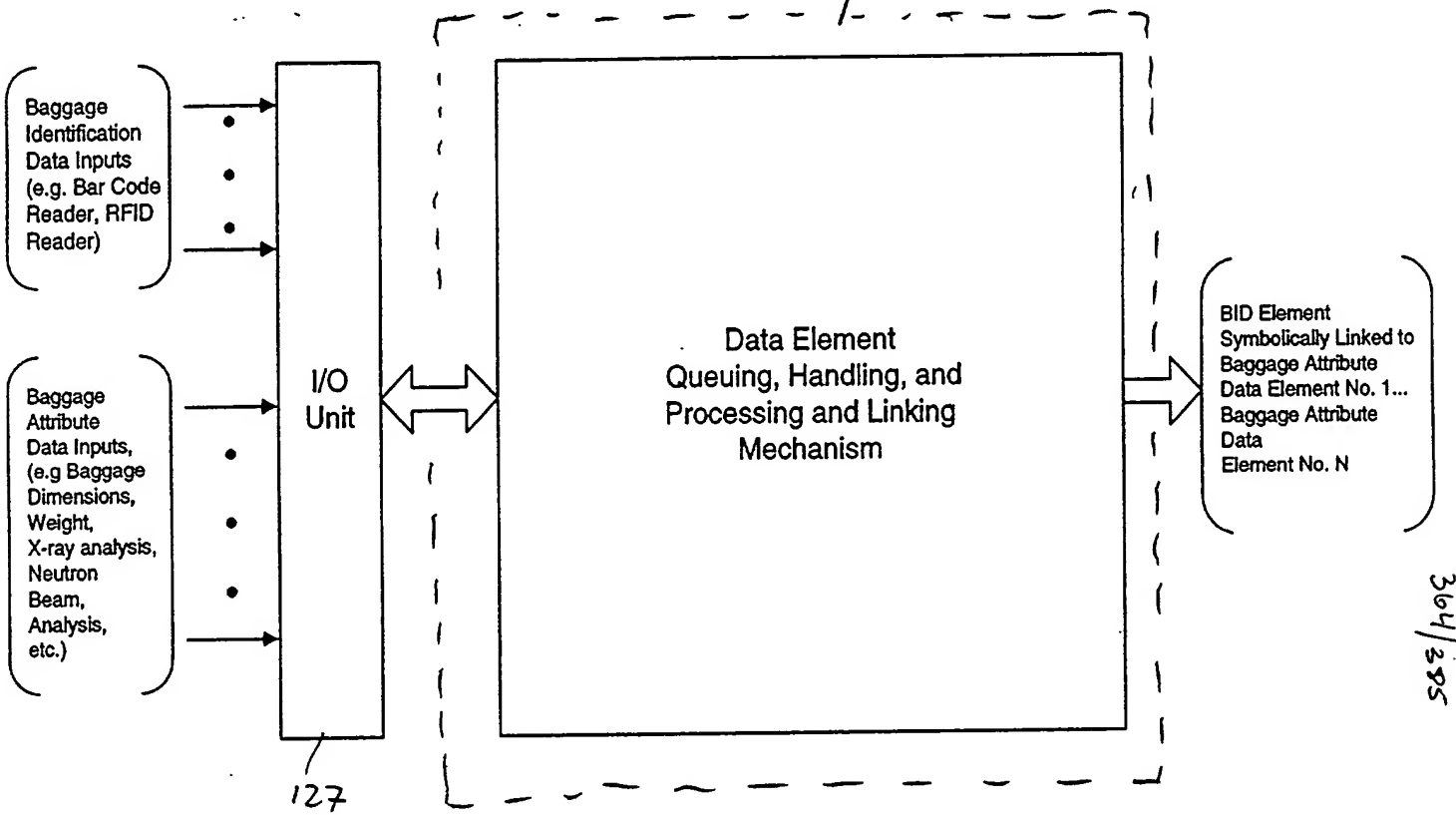

FIG. 68C4

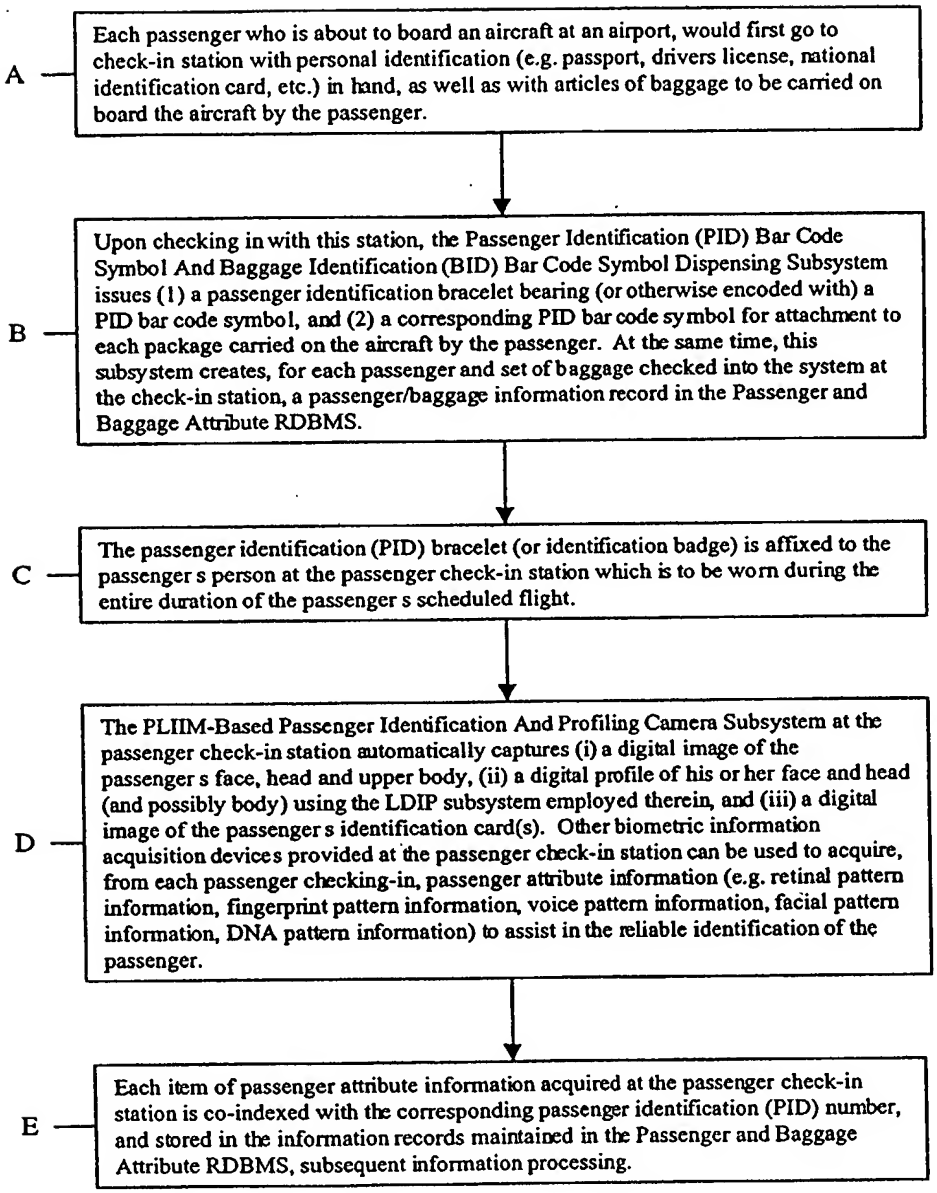
A
Each passenger who is about to board an aircraft at an airport, would first go to check-in station with personal identification (e.g. passport, drivers license, national identification card, etc.) in hand, as well as with articles of baggage to be carried on board the aircraft by the passenger.
B
Upon checking in with this station, the Passenger Identification (PID) Bar Code Symbol And Baggage Identification (BID) Bar Code Symbol Dispensing Subsystem issues (1) a passenger identification bracelet bearing (or otherwise encoded with) a PID bar code symbol, and (2) a corresponding PID bar code symbol for attachment to each package carried on the aircraft by the passenger. At the same time, this subsystem creates, for each passenger and set of baggage checked into the system at the check-in station, a passenger/baggage information record in the Passenger and Baggage Attribute RDBMS.
C
The passenger identification (PID) bracelet (or identification badge) is affixed to the passenger s person at the passenger check-in station which is to be worn during the entire duration of the passenger s scheduled flight.
D
The PLIIM-Based Passenger Identification And Profiling Camera Subsystem at the passenger check-in station automatically captures (i) a digital image of the passenger s face, head and upper body, (ii) a digital profile of his or her face and head (and possibly body) using the LDIP subsystem employed therein, and (iii) a digital image of the passenger s identification card(s). Other biometric information acquisition devices provided at the passenger check-in station can be used to acquire, from each passenger checking-in, passenger attribute information (e.g. retinal pattern information, fingerprint pattern information, voice pattern information, facial pattern information, DNA pattern information) to assist in the reliable identification of the passenger.
E
Each item of passenger attribute information acquired at the passenger check-in station is co-indexed with the corresponding passenger identification (PID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

FIG. 68D1

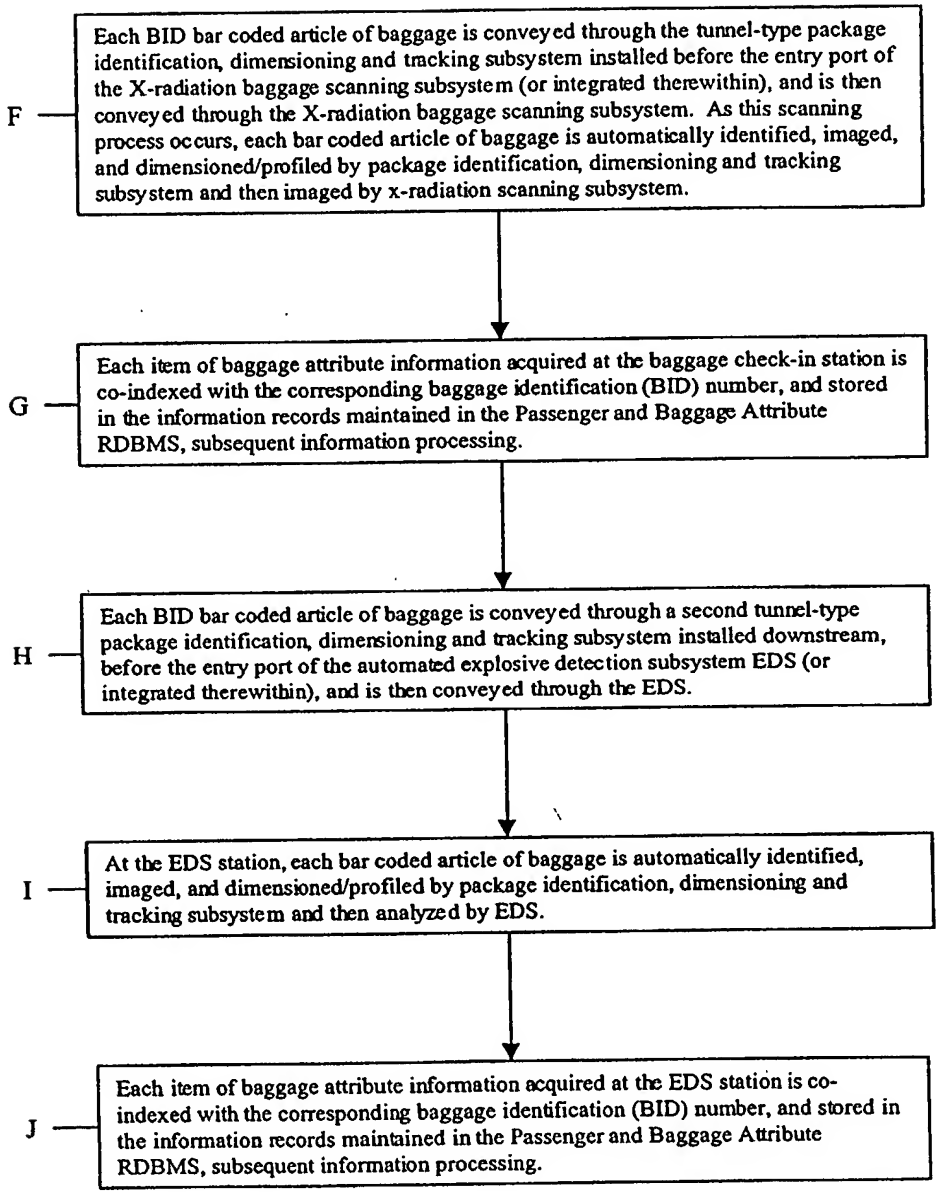
F
Each BID bar coded article of baggage is conveyed through the tunnel-type package identification, dimensioning and tracking subsystem installed before the entry port of the X-radiation baggage scanning subsystem (or integrated therewithin), and is then conveyed through the X-radiation baggage scanning subsystem. As this scanning process occurs, each bar coded article of baggage is automatically identified, imaged, and dimensioned/profiled by package identification, dimensioning and tracking subsystem and then imaged by x-radiation scanning subsystem.
G
Each item of baggage attribute information acquired at the baggage check-in station is co-indexed with the corresponding baggage identification (BID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.
H
Each BID bar coded article of baggage is conveyed through a second tunnel-type package identification, dimensioning and tracking subsystem installed downstream, before the entry port of the automated explosive detection subsystem EDS (or integrated therewithin), and is then conveyed through the EDS.
I
At the EDS station, each bar coded article of baggage is automatically identified, imaged, and dimensioned/profiled by package identification, dimensioning and tracking subsystem and then analyzed by EDS.
J
Each item of baggage attribute information acquired at the EDS station is co-indexed with the corresponding baggage identification (BID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

FIG. 68D2

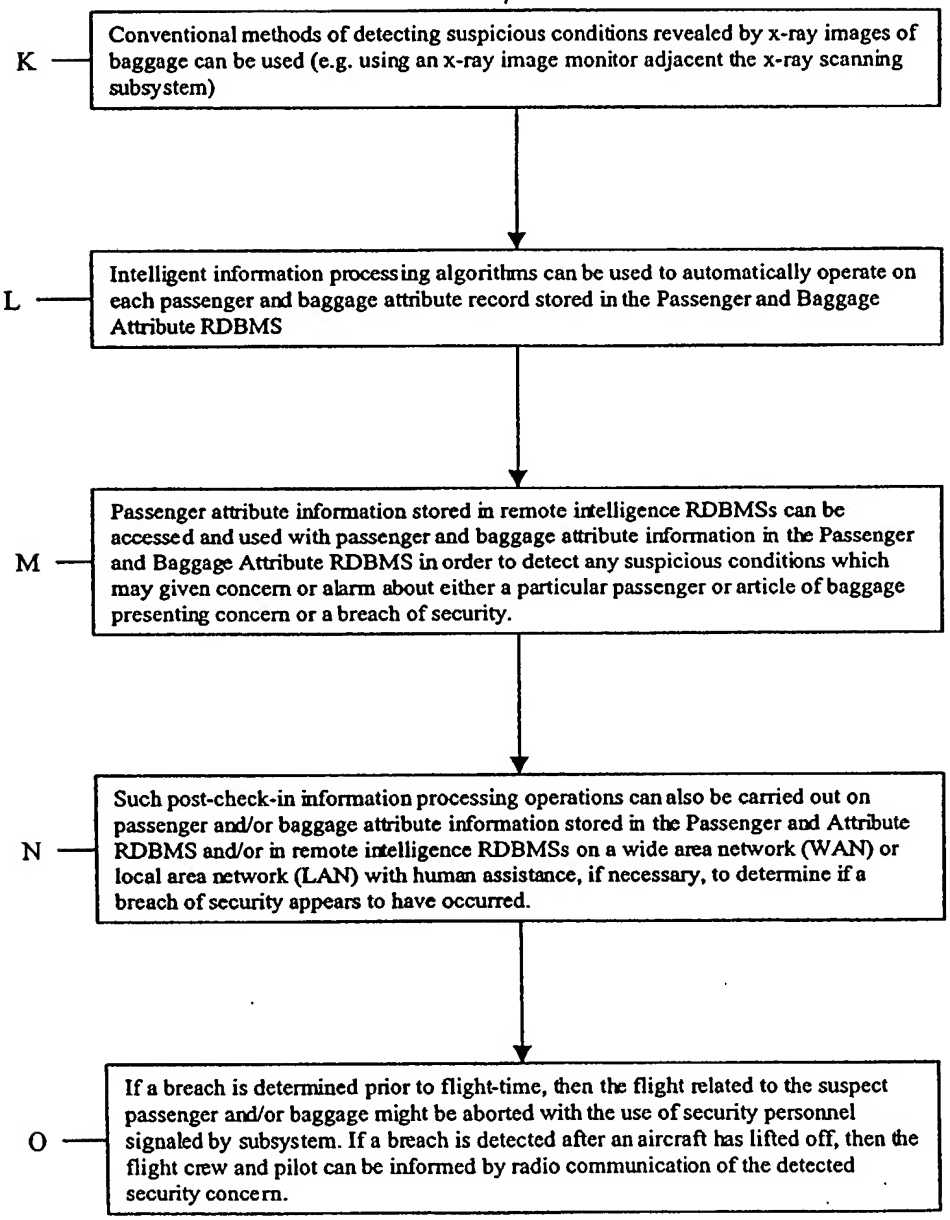
K
Conventional methods of detecting suspicious conditions revealed by x-ray images of baggage can be used (e.g. using an x-ray image monitor adjacent the x-ray scanning subsystem)
L
Intelligent information processing algorithms can be used to automatically operate on each passenger and baggage attribute record stored in the Passenger and Baggage Attribute RDBMS
M
Passenger attribute information stored in remote intelligence RDBMSs can be accessed and used with passenger and baggage attribute information in the Passenger and Baggage Attribute RDBMS in order to detect any suspicious conditions which may given concern or alarm about either a particular passenger or article of baggage presenting concern or a breach of security.
N
Such post-check-in information processing operations can also be carried out on passenger and/or baggage attribute information stored in the Passenger and Attribute RDBMS and/or in remote intelligence RDBMSs on a wide area network (WAN) or local area network (LAN) with human assistance, if necessary, to determine if a breach of security appears to have occurred.
O
If a breach is determined prior to flight-time, then the flight related to the suspect passenger and/or baggage might be aborted with the use of security personnel signaled by subsystem. If a breach is detected after an aircraft has lifted off, then the flight crew and pilot can be informed by radio communication of the detected security concern.

FIG. 68D3

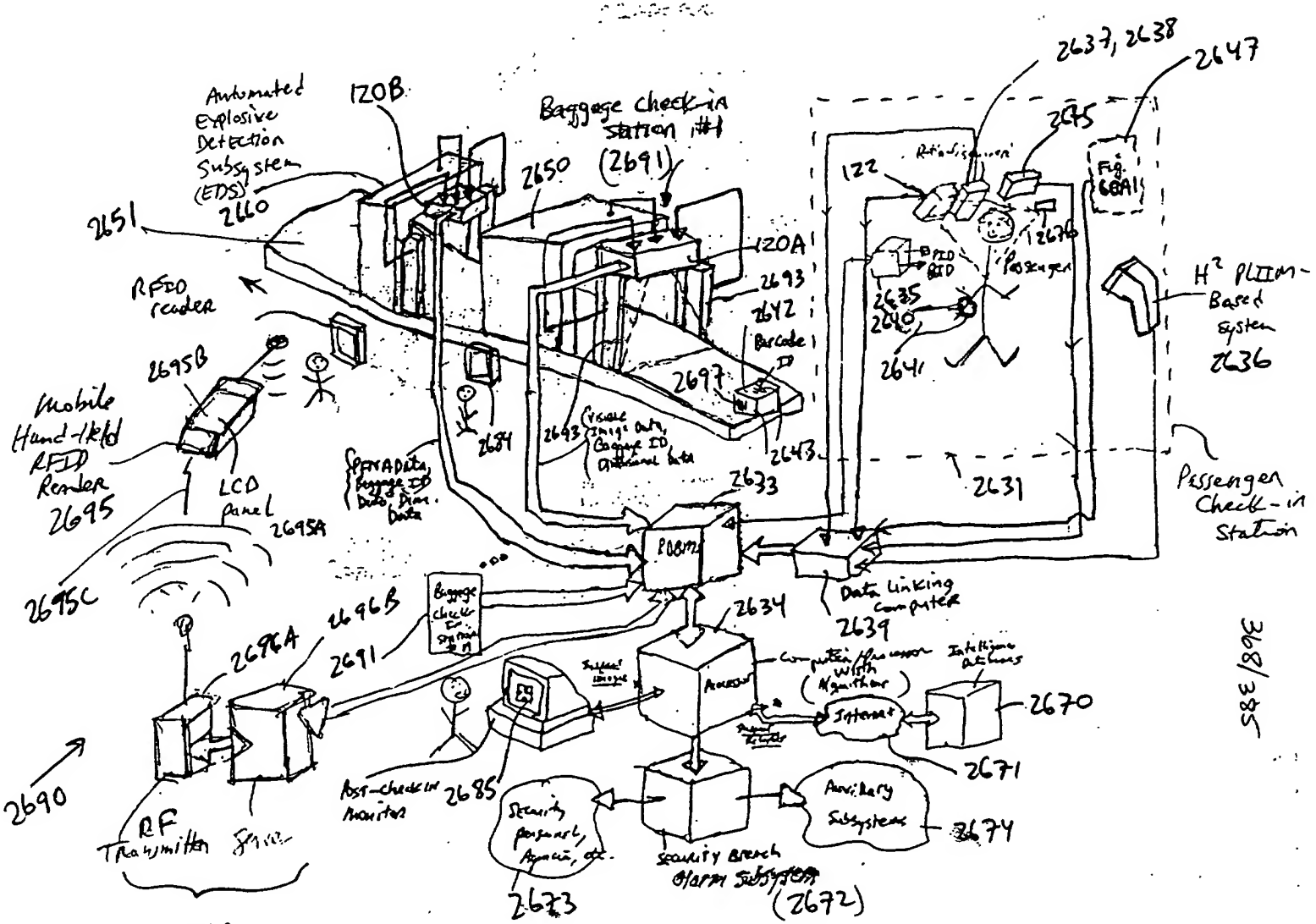
Automated Explosive Detection Subsystem (EDS) 2660
120B
Baggage check-in station #1 (2691)
2650
2651
120A
2693
2692 Barcode ID
2697
2643
2633
2631
2637, 2638
2647
2645
122
2646
2635
2640
2641
H² PLUM-Based System 2636
Passenger Check-in Station
RFID reader
2695B
Mobile Hand-Held RFID Reader 2695
LCD panel 2695A
2695C
2694
PLUM
Data Linking Computer 2639
2634
2696A
2696B
2691
2690
RF Transmitter
Post-check-in Monitor 2685
Internet
2670
2671
Security personnel, Agencies, etc.
2673
Security Breach Alarm Subsystem (2672)
Auxiliary Subsystem 2674
2696

FIG. 69A

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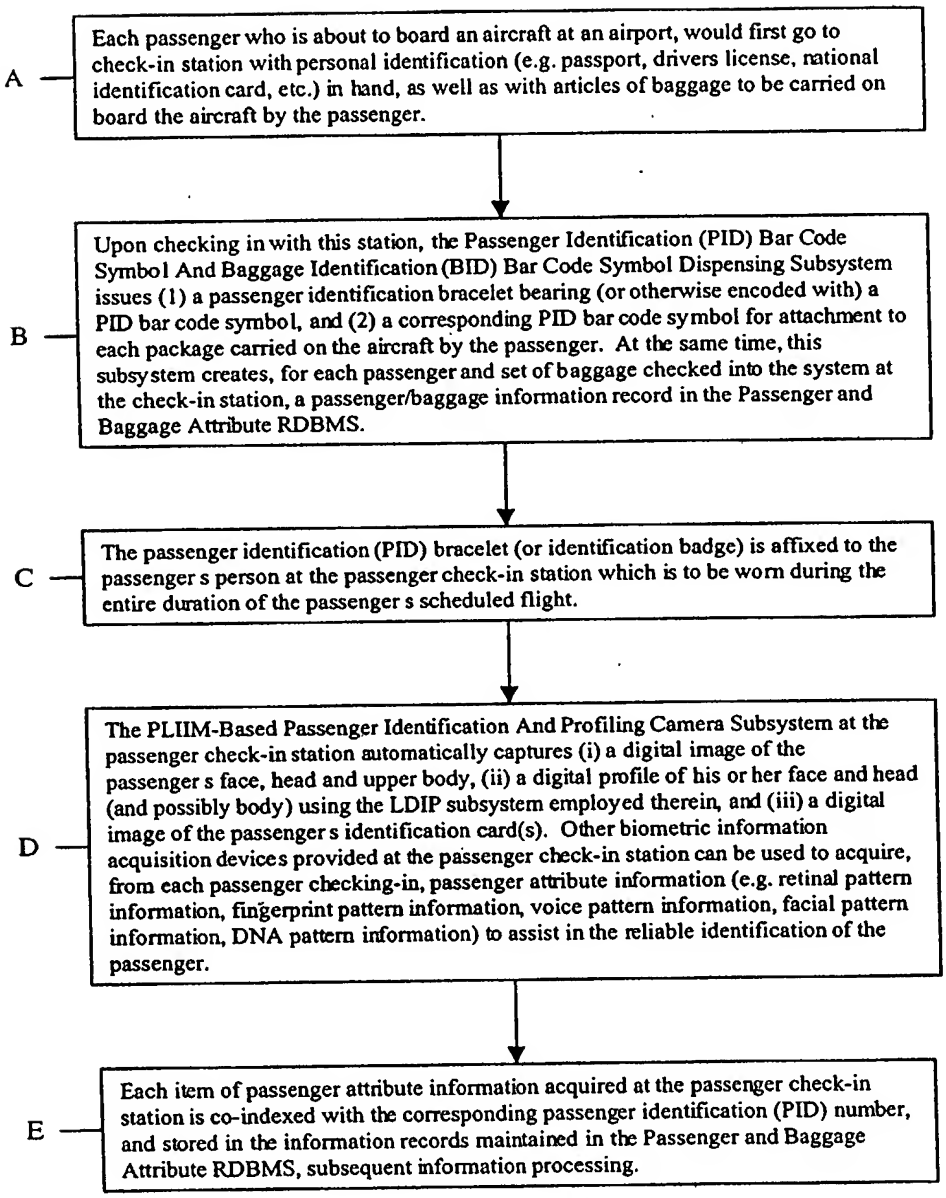

FIG. 69B1

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F — Each BID bar coded article of baggage is conveyed through the tunnel-type package identification, dimensioning and tracking subsystem installed before the entry port of the X-radiation baggage scanning subsystem (or integrated therewithin), and is then conveyed through the X-radiation baggage scanning subsystem. As this scanning process occurs, each bar coded article of baggage is automatically identified, imaged, and dimensioned/profiled by package identification, dimensioning and tracking subsystem and then imaged by x-radiation scanning subsystem.

G — Each item of baggage attribute information acquired at the baggage check-in station is co-indexed with the corresponding baggage identification (BID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

H — Each BID bar coded article of baggage is conveyed through a second tunnel-type package identification, dimensioning and tracking subsystem installed downstream, before the entry port of the automated explosive detection subsystem EDS (or integrated therewithin), and is then conveyed through the EDS.

I — At the EDS station, each bar coded article of baggage is automatically identified, imaged, and dimensioned/profiled by package identification, dimensioning and tracking subsystem and then analyzed by EDS.

J — Each item of baggage attribute information acquired at the EDS station is co-indexed with the corresponding baggage identification (BID) number, and stored in the information records maintained in the Passenger and Baggage Attribute RDBMS, subsequent information processing.

FIG 69B2

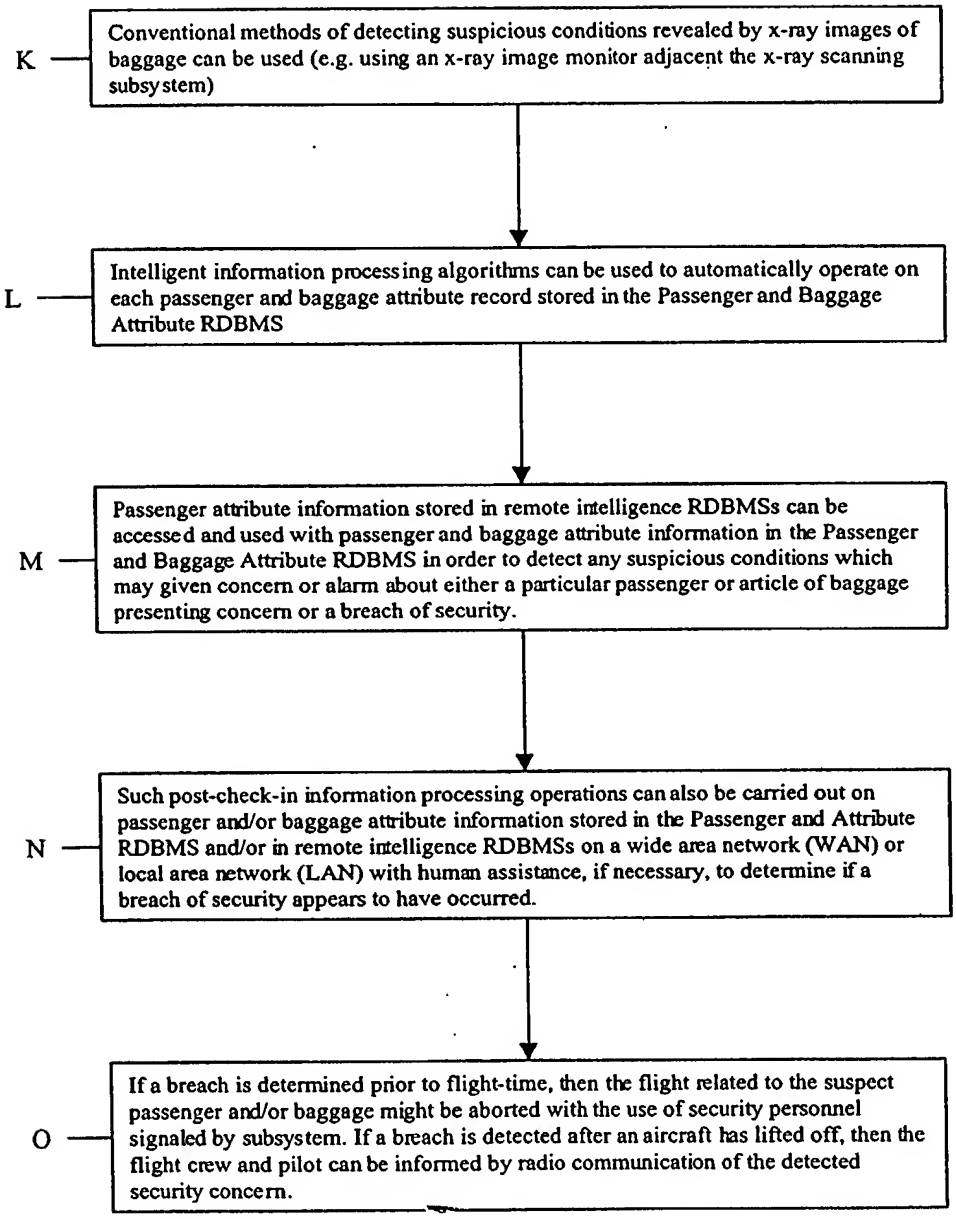

K
Conventional methods of detecting suspicious conditions revealed by x-ray images of baggage can be used (e.g. using an x-ray image monitor adjacent the x-ray scanning subsystem)
L
Intelligent information processing algorithms can be used to automatically operate on each passenger and baggage attribute record stored in the Passenger and Baggage Attribute RDBMS
M
Passenger attribute information stored in remote intelligence RDBMSs can be accessed and used with passenger and baggage attribute information in the Passenger and Baggage Attribute RDBMS in order to detect any suspicious conditions which may given concern or alarm about either a particular passenger or article of baggage presenting concern or a breach of security.
N
Such post-check-in information processing operations can also be carried out on passenger and/or baggage attribute information stored in the Passenger and Attribute RDBMS and/or in remote intelligence RDBMSs on a wide area network (WAN) or local area network (LAN) with human assistance, if necessary, to determine if a breach of security appears to have occurred.
O
If a breach is determined prior to flight-time, then the flight related to the suspect passenger and/or baggage might be aborted with the use of security personnel signaled by subsystem. If a breach is detected after an aircraft has lifted off, then the flight crew and pilot can be informed by radio communication of the detected security concern.

FIG. 69B3

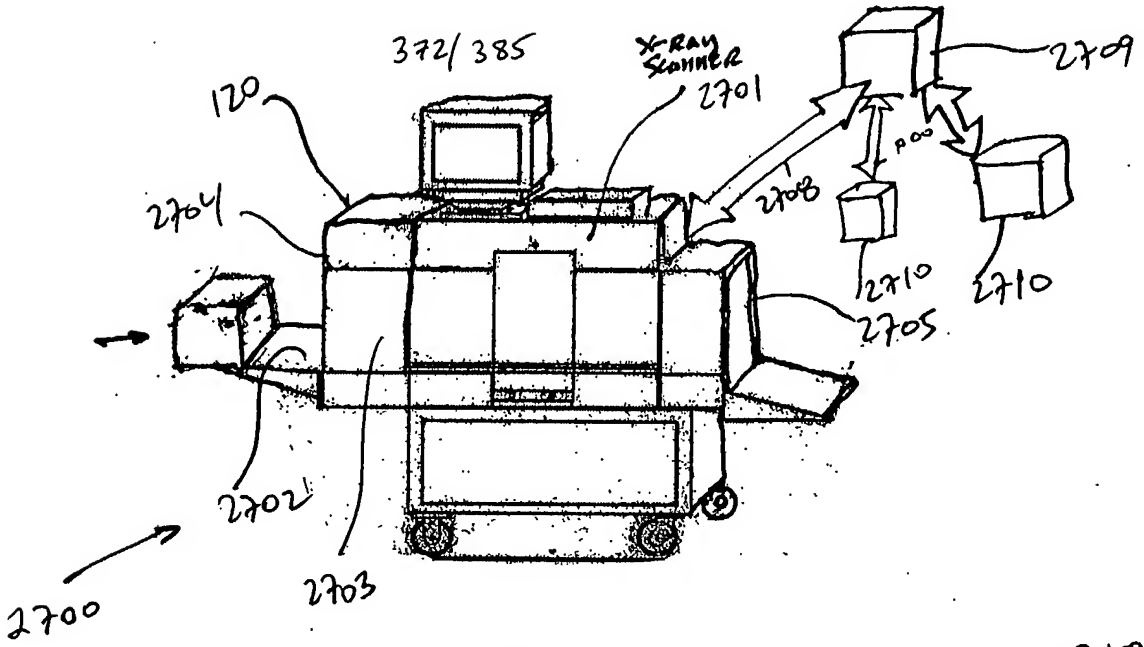


FIG 70A

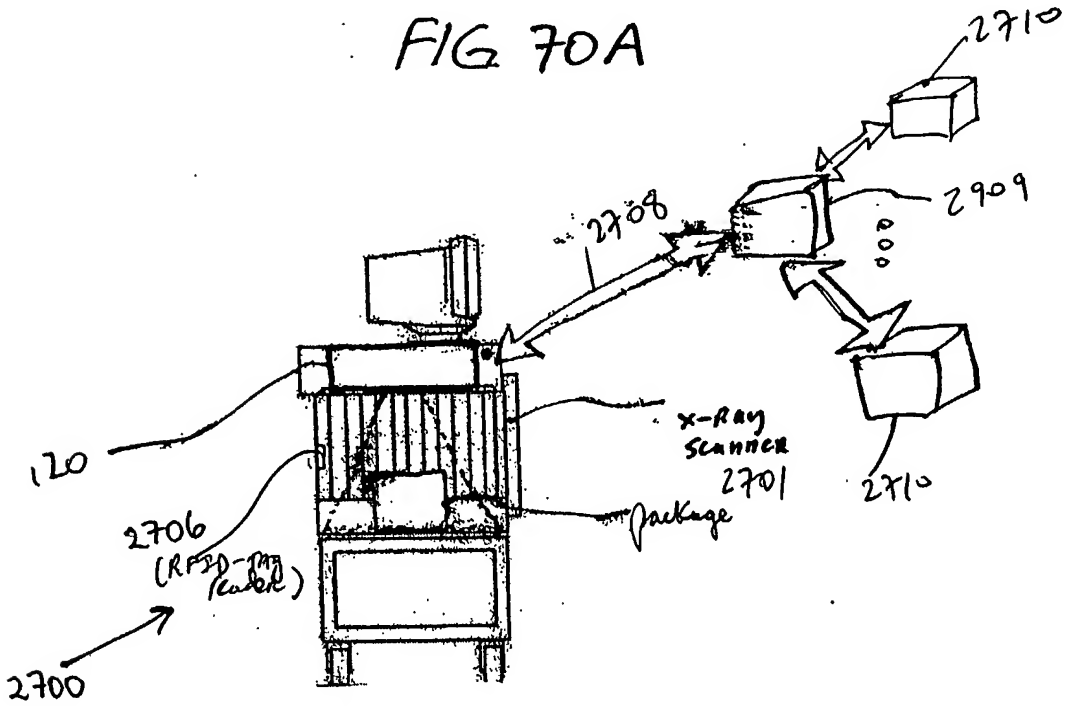


FIG. 70B

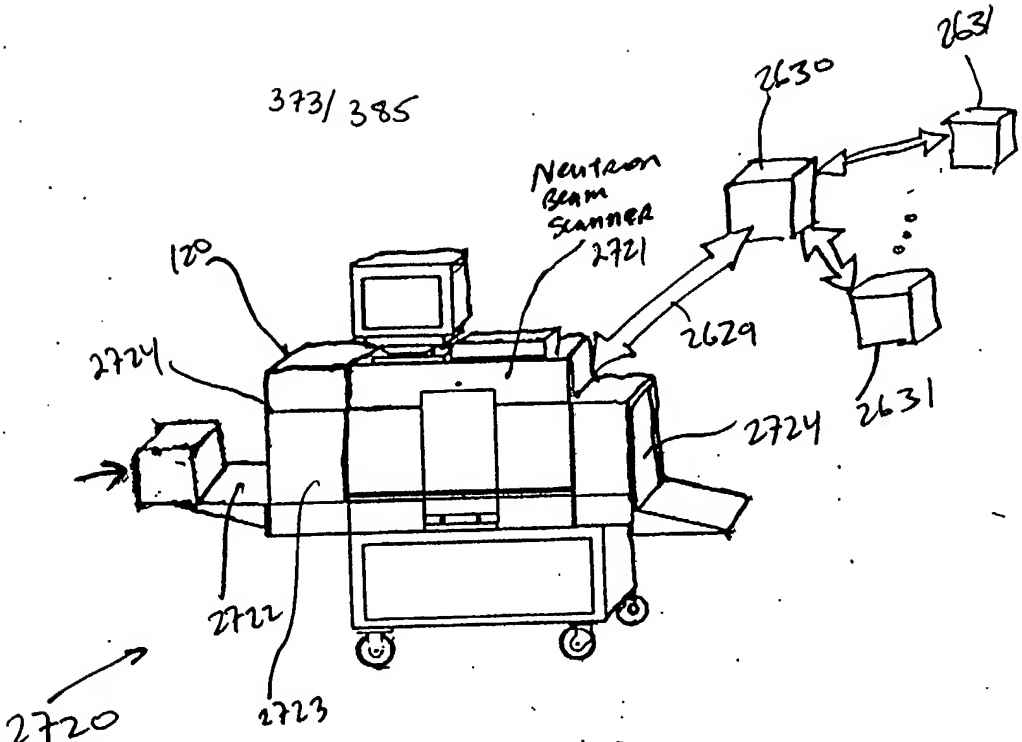


FIG. 71A

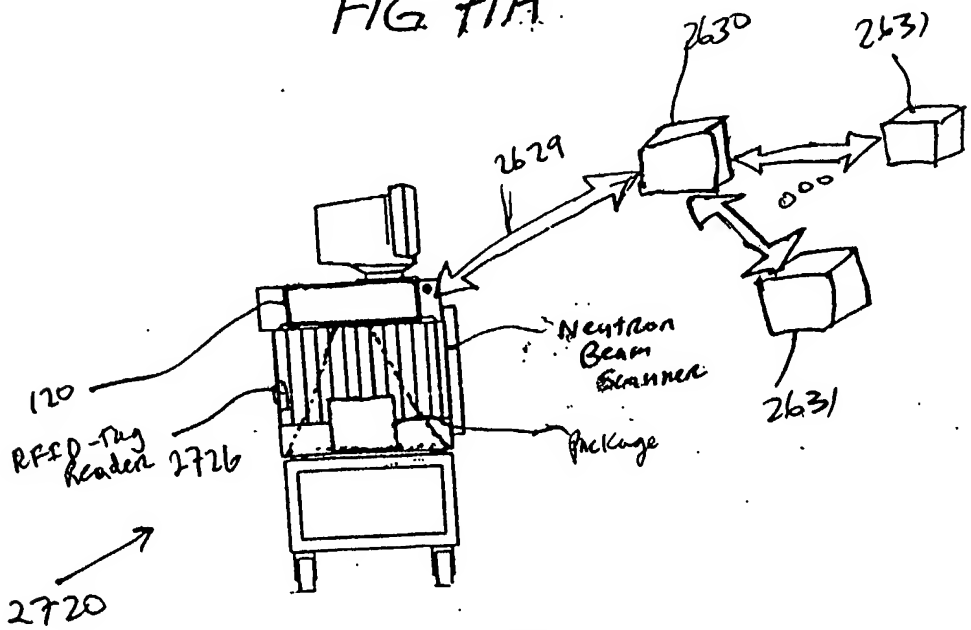


FIG. 71B

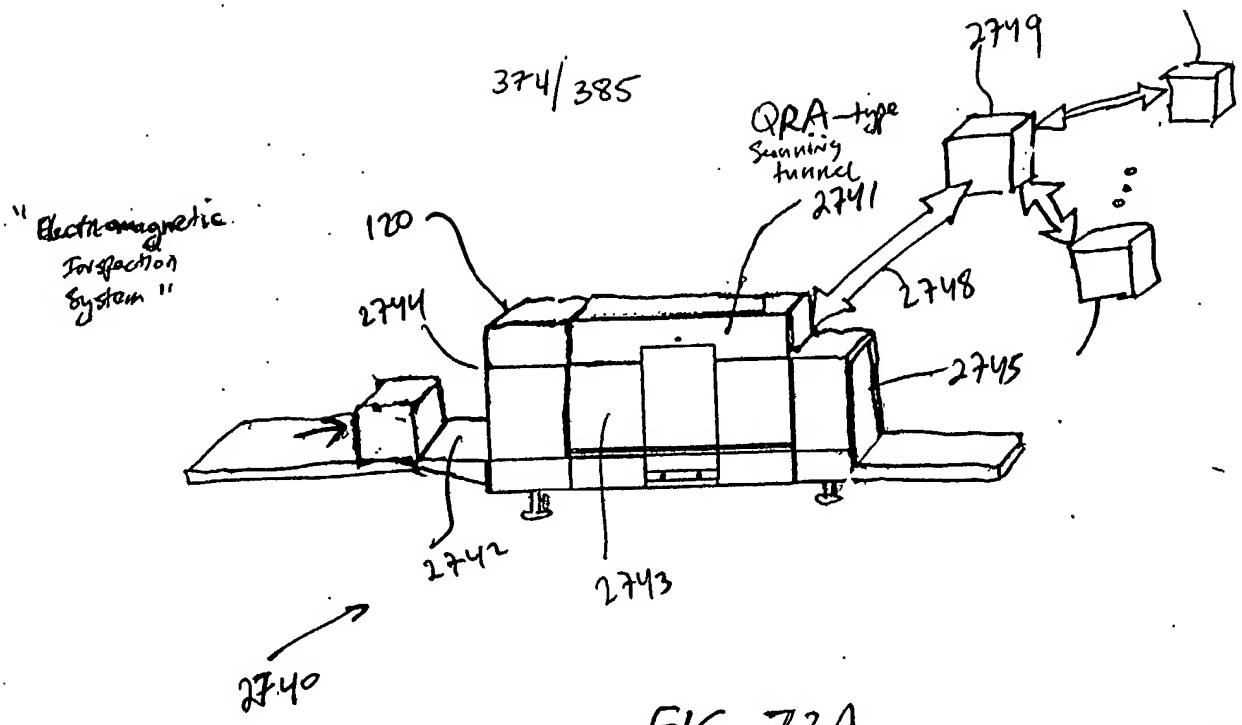


FIG. 72A

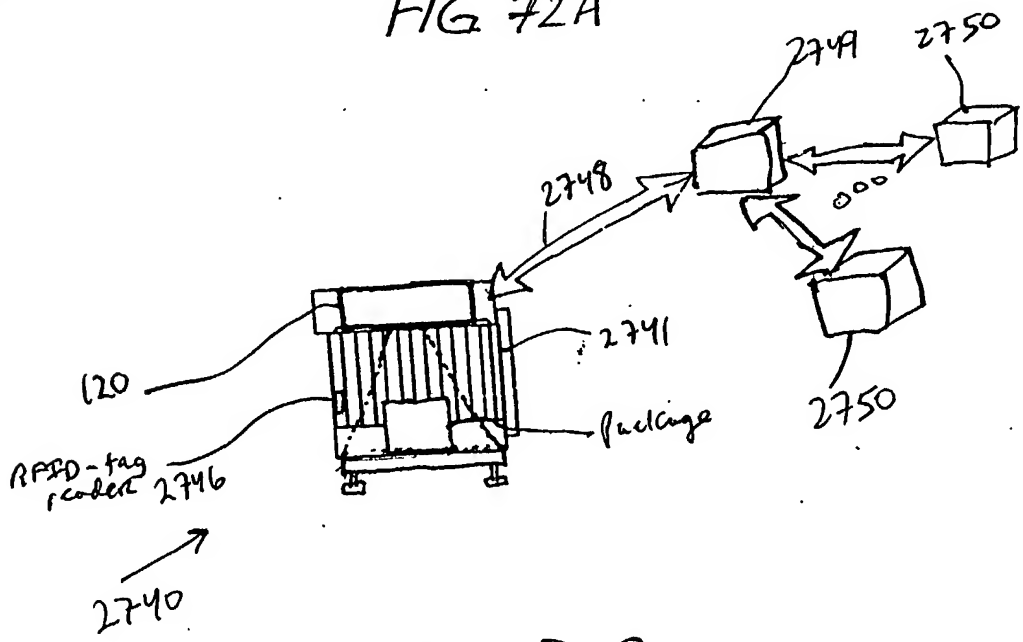


FIG. 72B

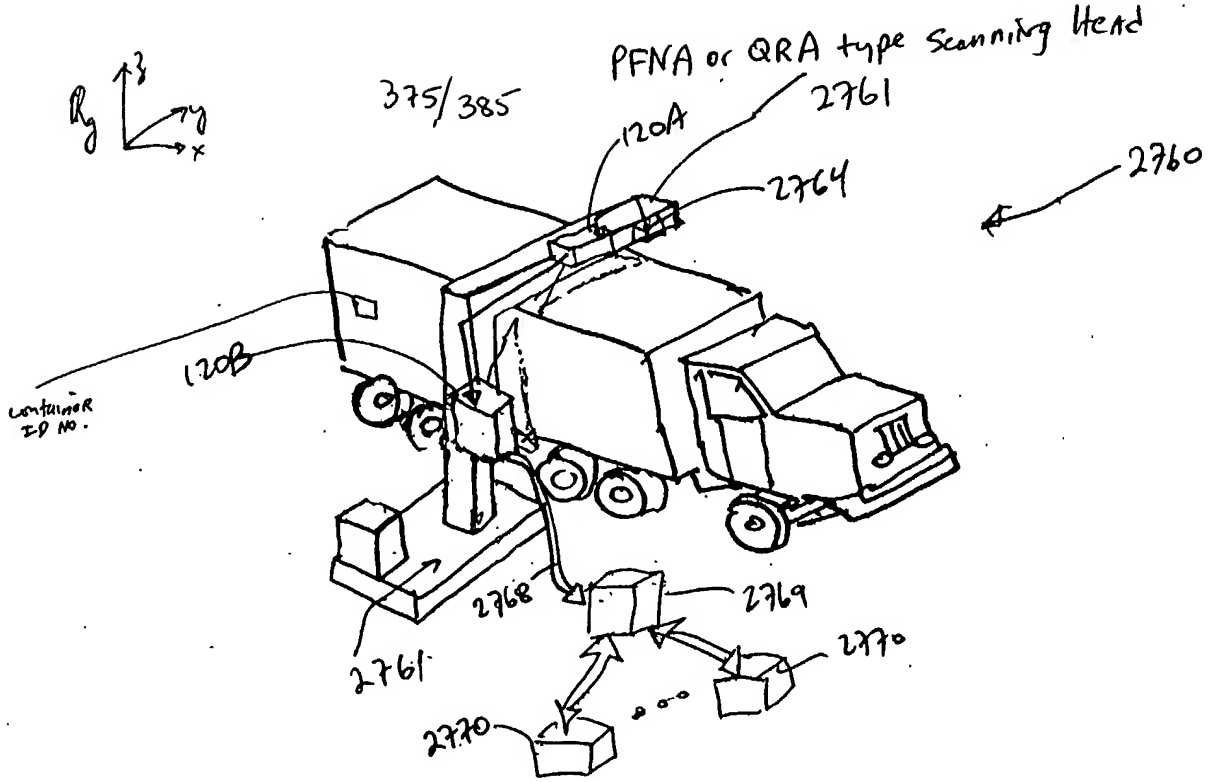

PFNA or QRA type Scanning Head
Rg
z
y
x
375/385
120A
2761
2764
2760
120B
container ID NO.
2768
2769
2770
2761
2770
2770

FIG. 73

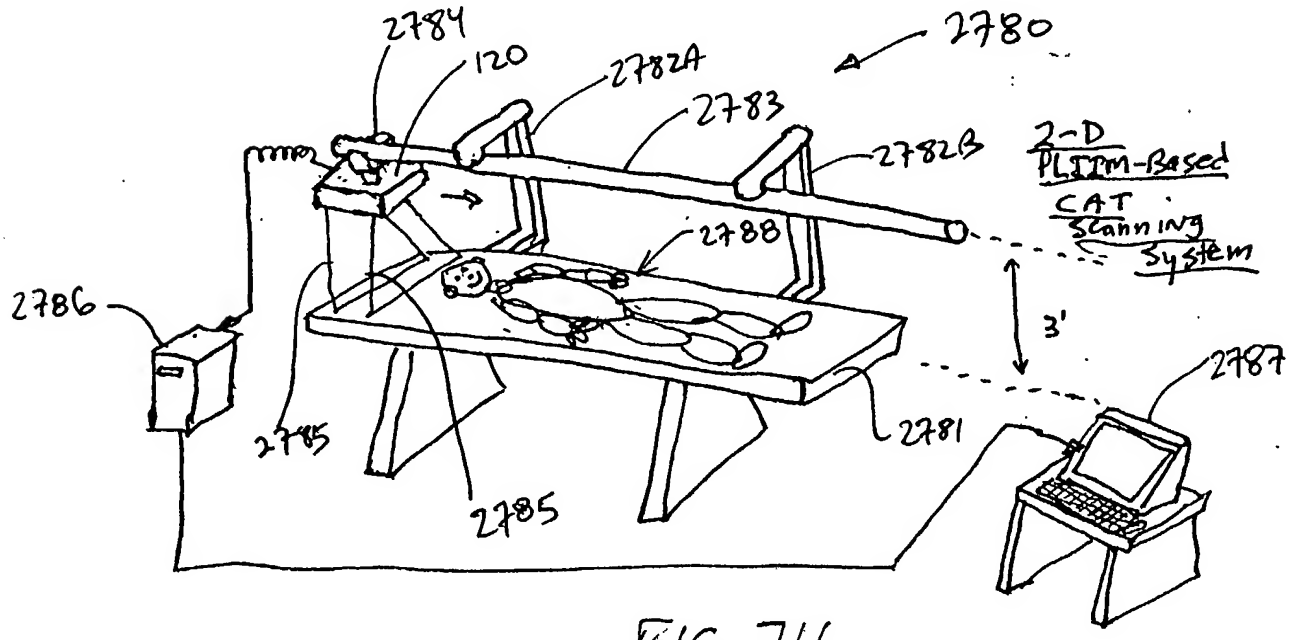
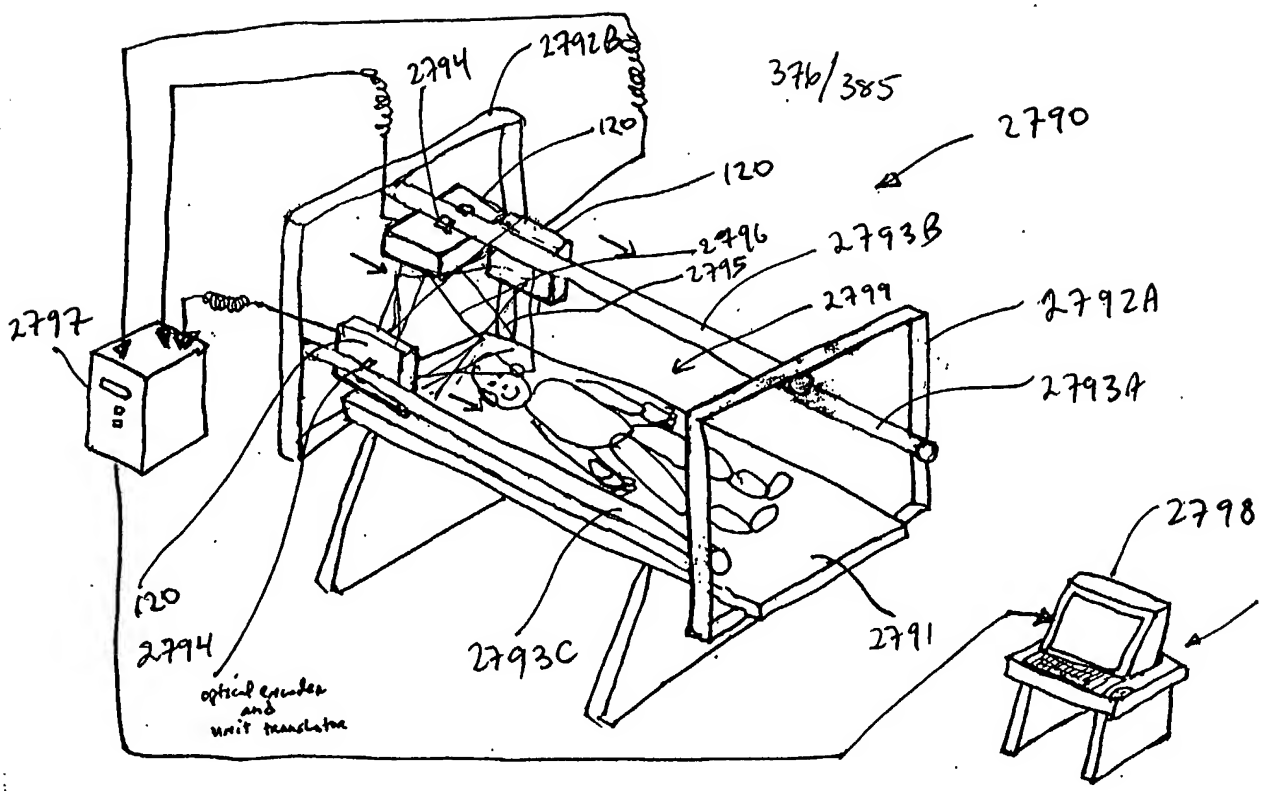

2784
120
2782A
2780
2783
2782B
2-D PLIM-Based CAT Scanning System
2788
2786
3'
2787
2785
2781
2785

FIG. 74



3-D PLIIM-Based CAT Medical Scanning System

FIG. 75

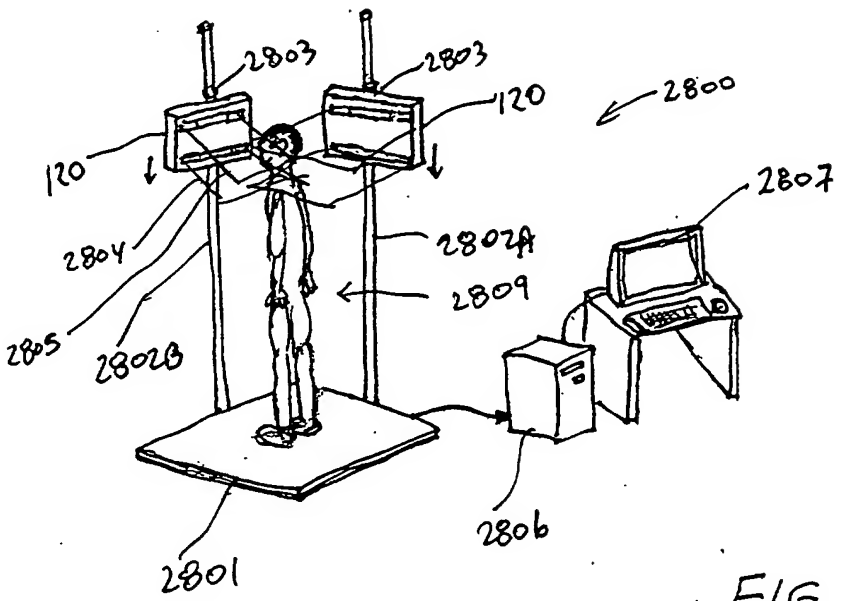


FIG. 76

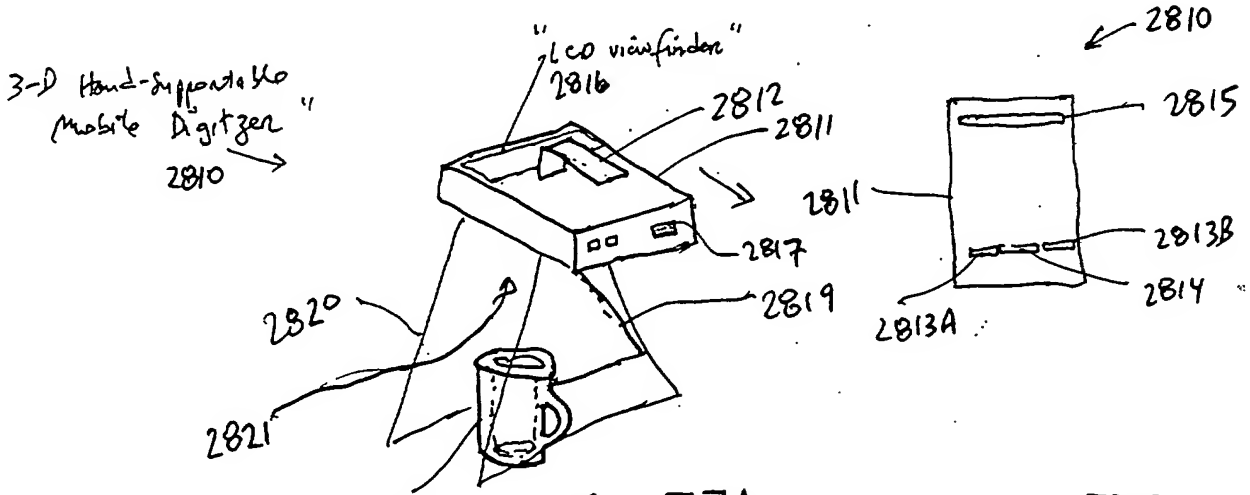


FIG. 77A

FIG. 77B

20020220 "2884+8007"

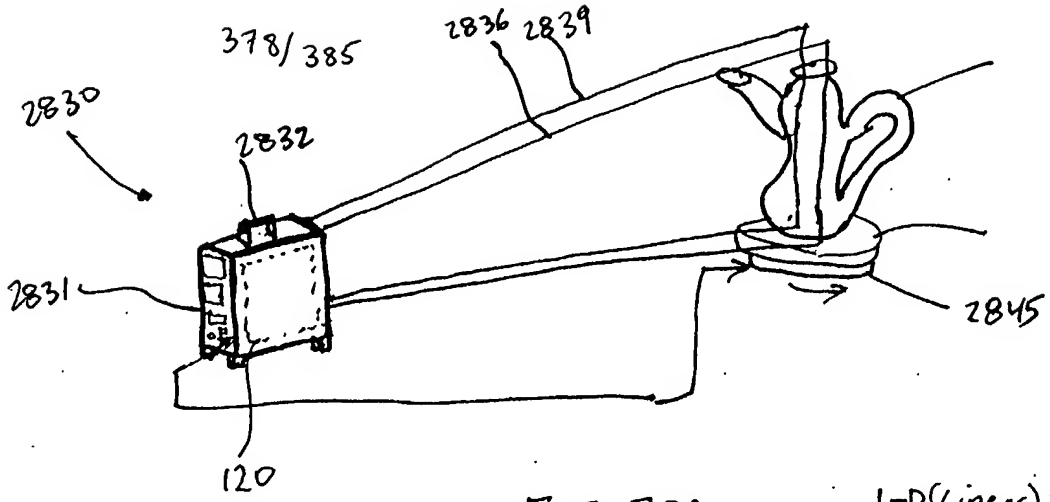


FIG. 78A

1-D (Linear) sensor

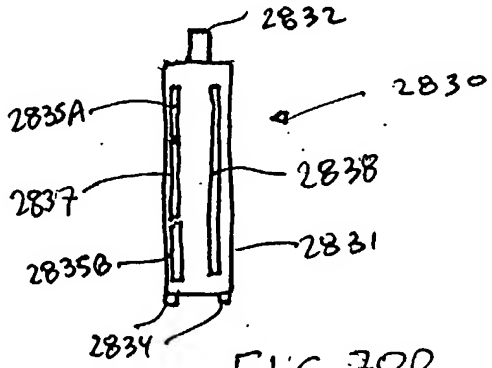


FIG. 78B

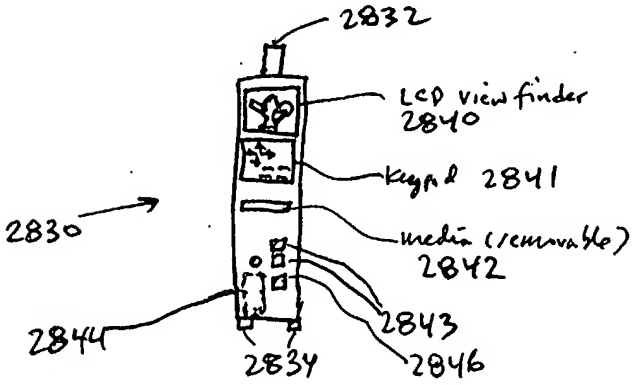


FIG. 78C

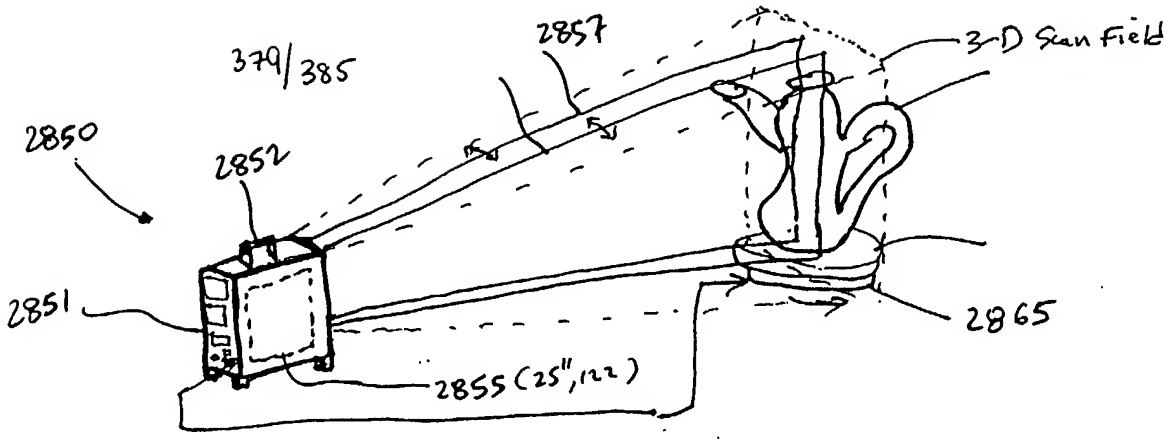


FIG. 79A

~~3-D~~(AREA) sensor

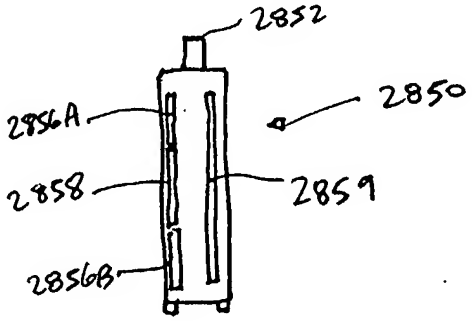


FIG. 79B

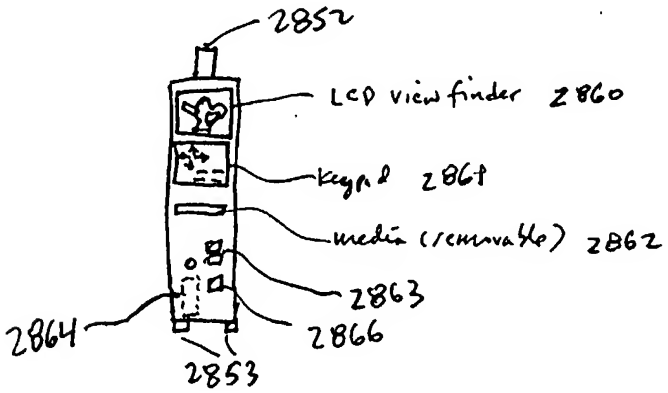


FIG. 79C

Automatic Vehicle Identification (AVI) System of present Invention

* employing overhead profiling and imaging during license plate image capture

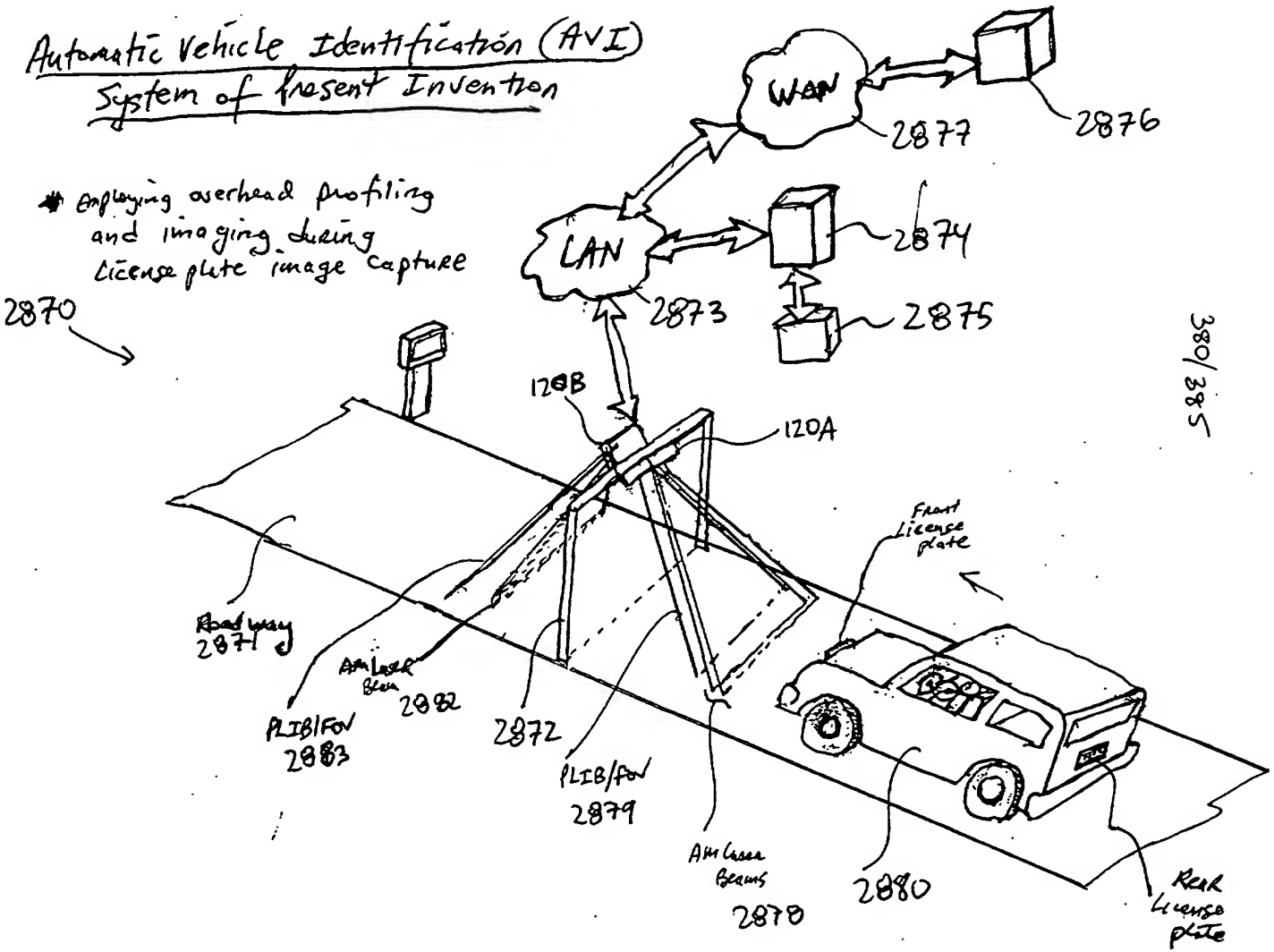


FIG. 80.

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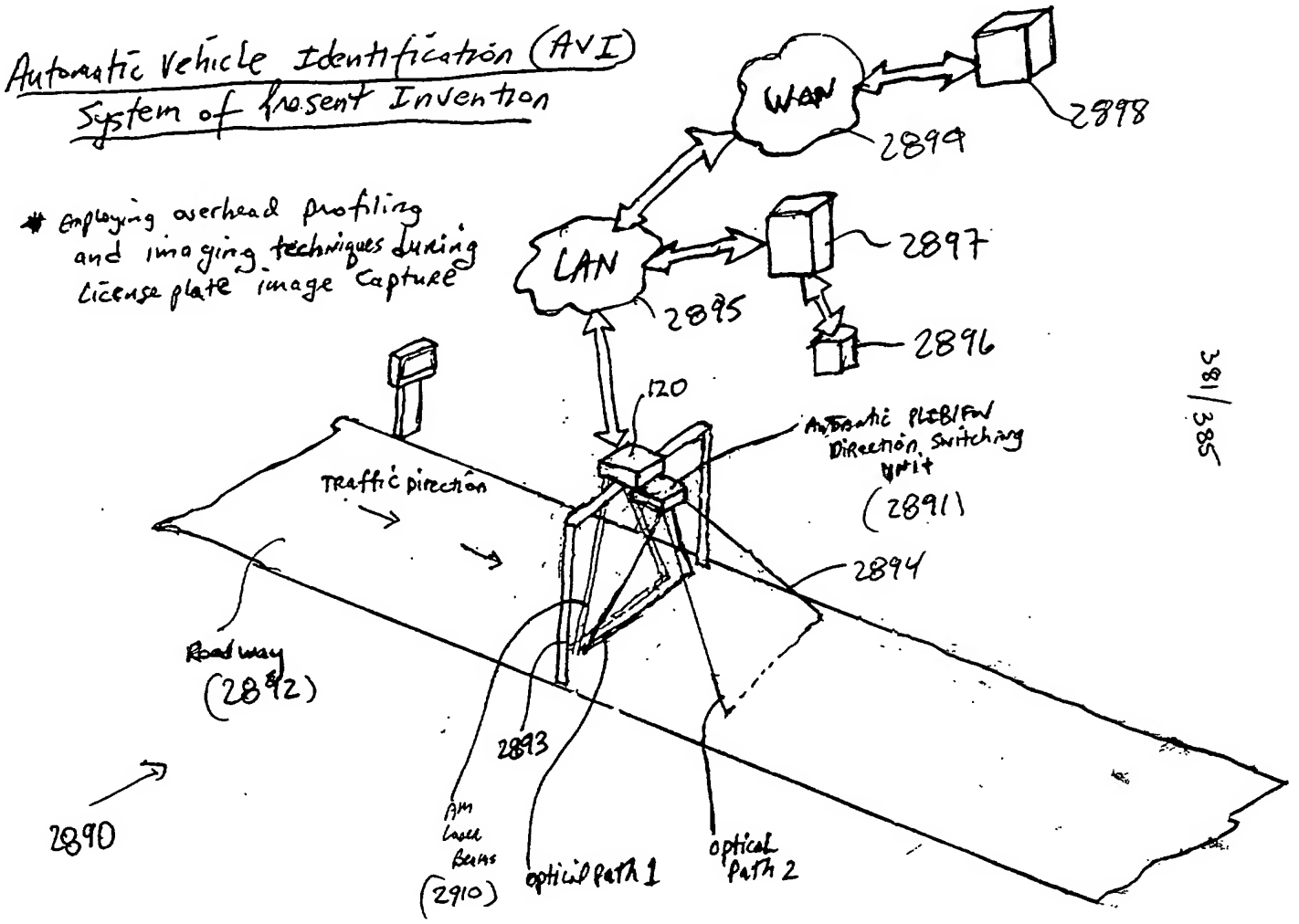


FIG. 81A

381/385

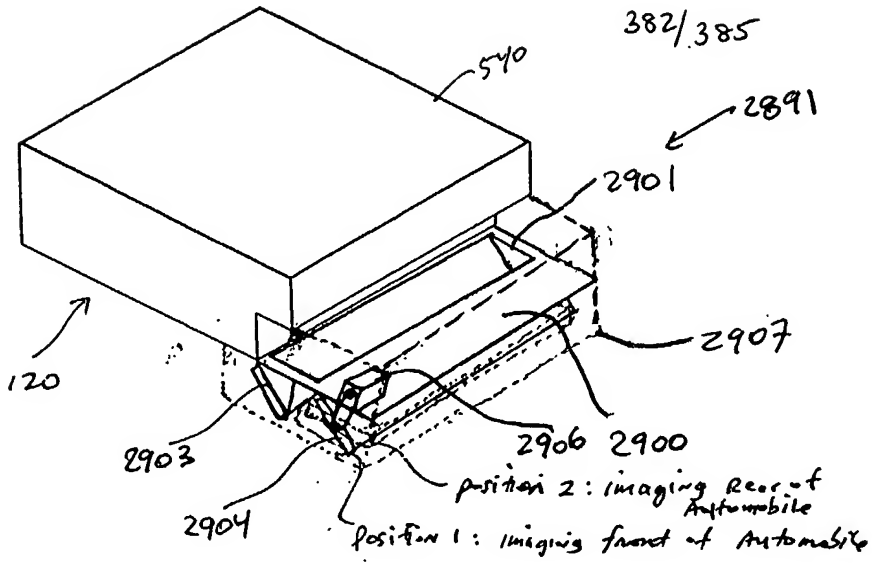


FIG. 81B

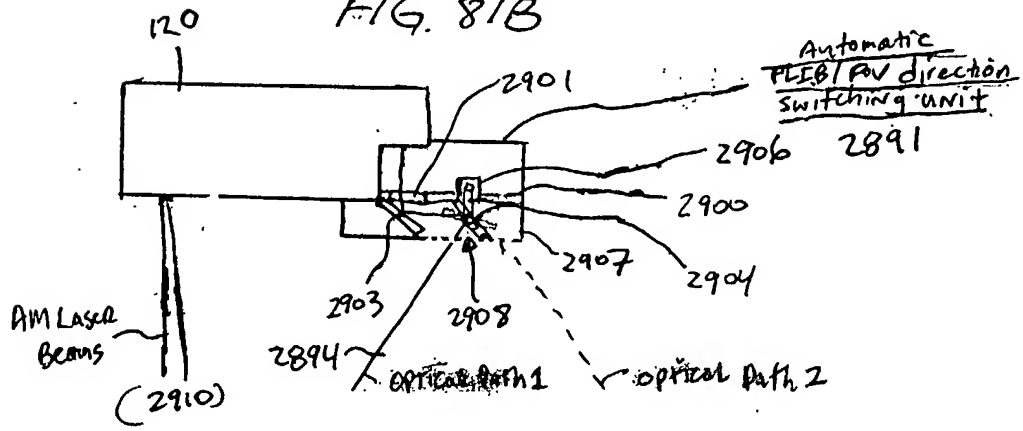


FIG. 81C

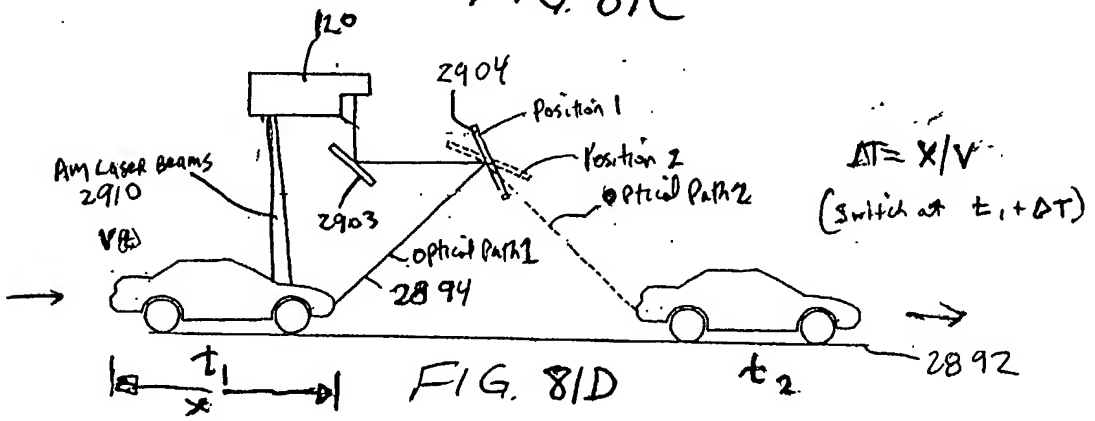
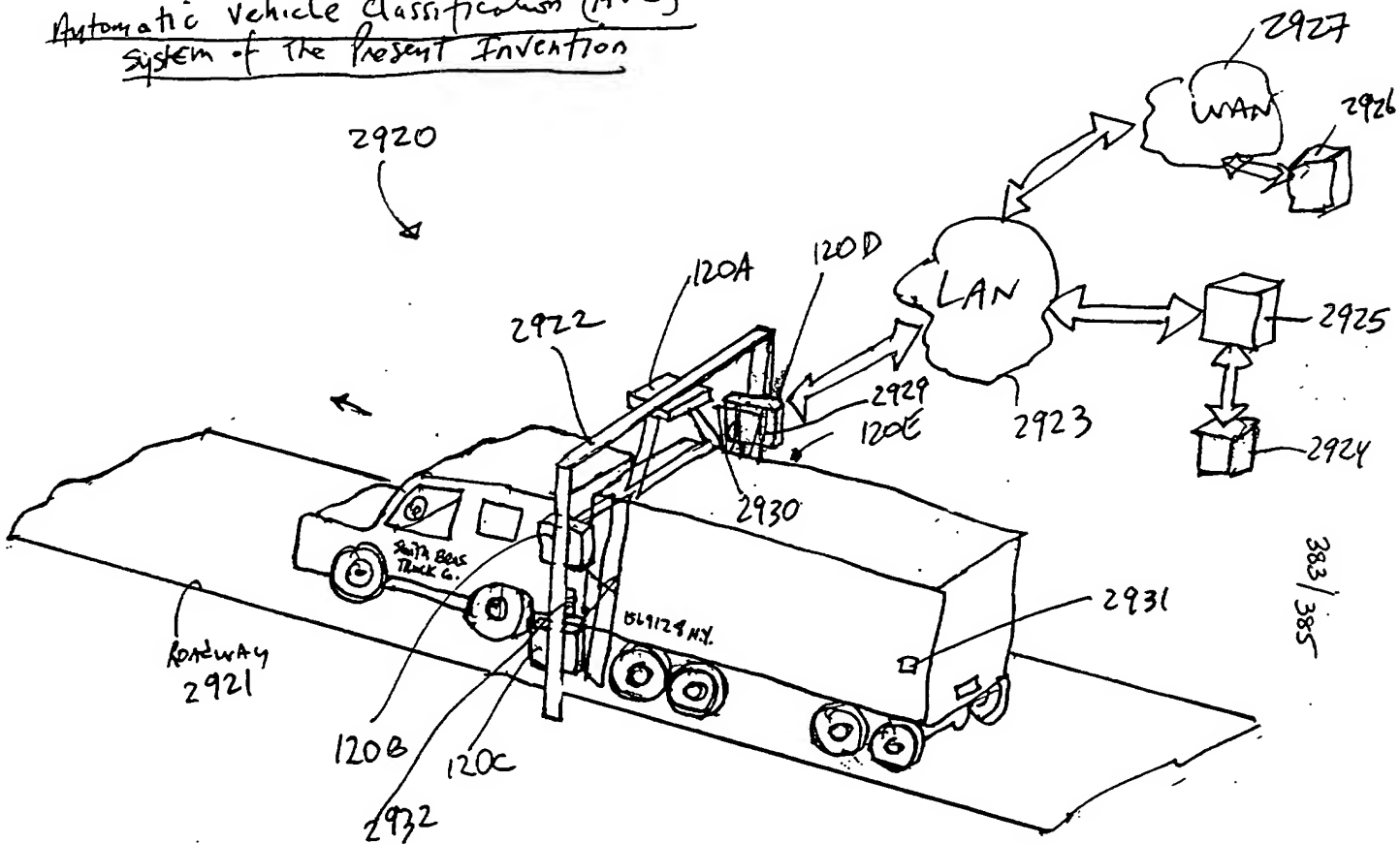


FIG. 81D

Automatic Vehicle classification (AVC) System of the Present Invention



* Employing overhead and lateral profiling and imaging techniques

FIG. 82

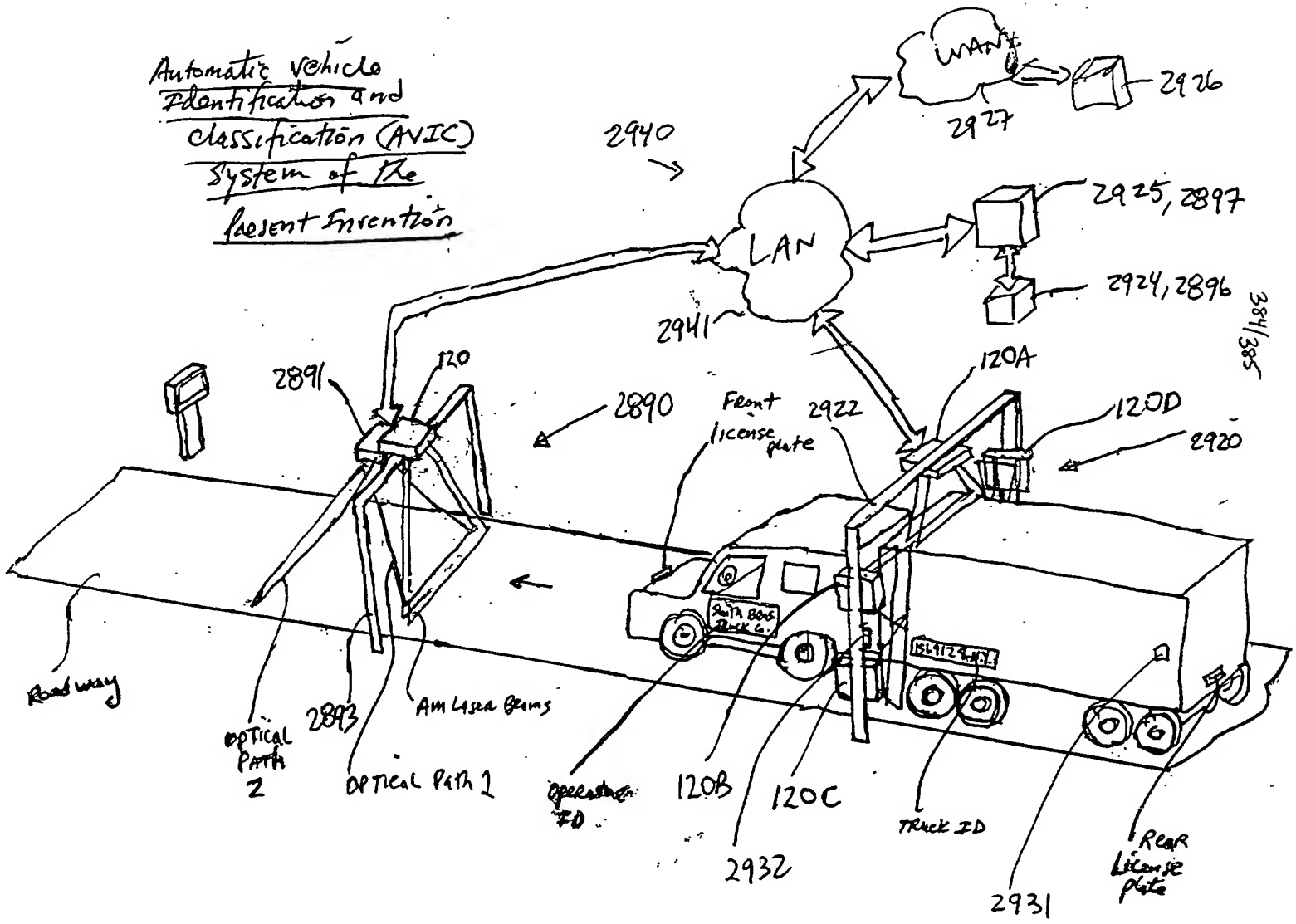

Automatic Vehicle Identification and Classification (AVIC) System of the Present Invention
2940
WAN
2927
2926
LAN
2925, 2897
2924, 2896
2941
384/385
2891
120
2890
Front license plate
2922
120A
120D
2920
Roadway
2893
Am Laser Beams
Optical Path 2
Optical Path 1
Operator ID
120B
120C
2932
Truck ID
2931
Rear License plate

FIG. 83

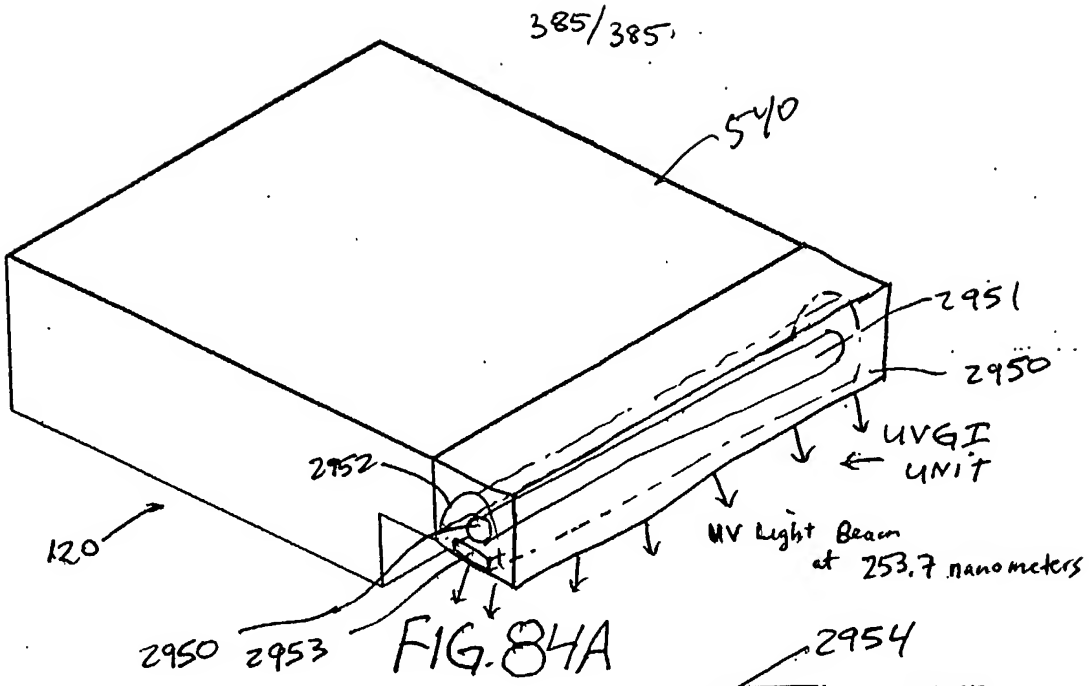


FIG. 84A

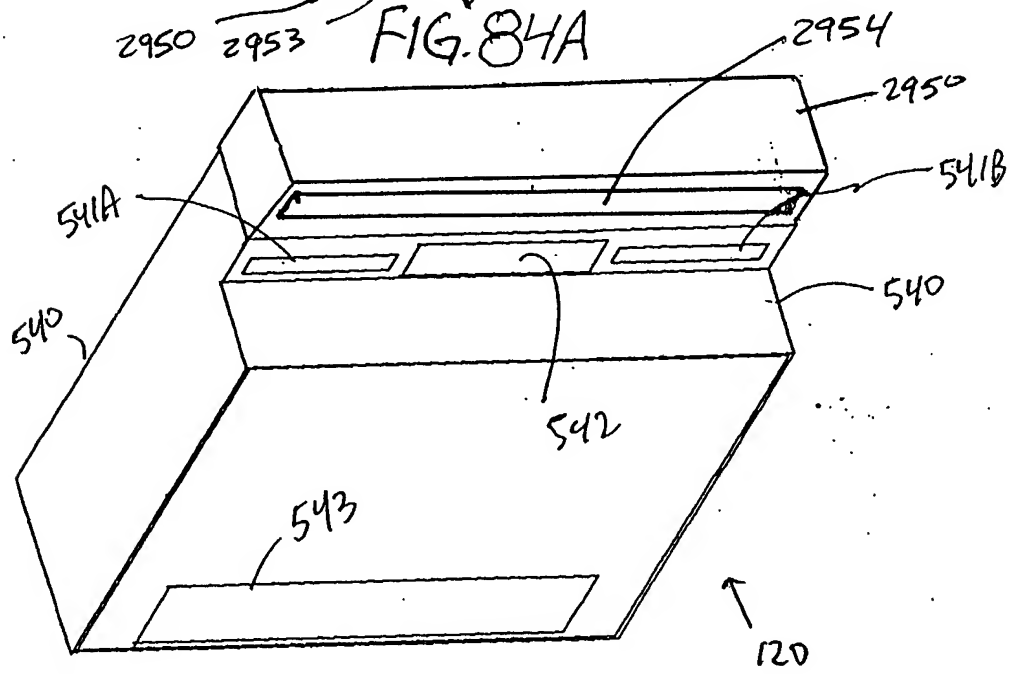


FIG. 84B